

This species, and others in Mainland SE Asia, are sometimes abundant. By contrast, in the lowlands of the Sundaic Region the main species is *S. javanica*, which is usually found consistently and yet always at low densities. The sterile leaf of *S. javanica*, especially the leaves of juveniles, can be confused with Euphorbiaceae and with Malvaceae because the leaf is often three-nerved, long-stalked and bears stipules. However, the leaf stalk of *Sloanea* is not swollen in the typical Malvacean fashion. The lowermost nerves crowd the base, and if clearly three-nerved then they join the midrib slightly above the leaf base. The twigs are resinous rather than mucilaginous, and the blade and young parts are never with stellate hairs. The standard Malay name for the tree is *mendong* or *merchapan* in Iban. The mature dehiscent fruit is illustrated in the *Flora of Peninsular Malaysia* web site and shows a pink-red wall, orange arils and black seeds.

DUBOUZETIA. [Commemorates the French navigator J. du Bouzet, d. 1867.] A genus of 11 species, one of which reaches the Moluccas. The molecular study cited indicates a sister relationship with *Elaeocarpus*. (Not illustrated.)

ACERATIUM. [Greek, "without a small horn" in reference to abruptly terminated anther.] A genus of 20 species found especially in Australia and New Guinea. *Aceratium oppositifolium* approaches the lesser Sunda Islands, and may be found in Sulawesi. It yields a big angular edible fruit, grown in Amboina and referred to as *belimbing-hutan*. Formerly described as an *Elaeocarpus*, it differs in the angular fruit and the opposite leaves. (Not illustrated.)



FABALES

A small order of only four families, and yet one that is most singularly important because it includes the Fabaceae, one of the most important of plant families. STEVENS *loc. cit.* says of the order "A rather unexpected group, but it is quite strongly supported." The tree topology is sufficiently unclear that you could find almost

any combination of linkages published in one study or another. Surianaceae 5/8, Australian, scattered globally. 1, *Suriana maritima*, coastal dune shrub, globally. Quilajaceae 1/3, small trees, southern S America. Further comments are reserved for the family treatments.



ROSIDS (FABIDS): FABALES

POLYGALACEAE

NAME: From the genus *Polygala*, as below.

OVERVIEW: The family Polygalaceae includes about 1000 species arranged in 18 genera with about half the species in *Polygala*. Their distribution is roughly cosmopolitan but absent from New Zealand and poor in Australia. It is a monophyletic family, and perhaps basal to the Fabales^{1,2}. In tropical Asia, the family is chiefly represented by trees of the genus *Xanthophyllum*, a genus that differs vegetatively from other genera by the accumulation of aluminum, by the multiple axillary buds, and by the laminar glands. Other regional representatives include herbs in the genus *Polygala*, as well as a single tree, and a few lianas in *Securidaca*.

Polygalaceae flowers are bisexual, five-parted and pea-like, with the lowermost petal folded to form a boat-shaped keel. The eight stamens are variously united and

fused to the petals (free in *Xanthophyllum*), the gynoecium of two carpels but a single cell with two or more essentially parietal ovules in two rows; the stigma small and two-lobed; the fruit irregularly dehiscent or not.

FIELD RECOGNITION: XANTHOPHYLLUM

Tree of mostly small stature, the bark is green-black, or in older trees pale tan or gray, with thick corky outer bark, warty and lenticellate, breaking apart.

Without exudate; the wood is yellow, oily, granular and crumbles between the fingers.

Simple leaves, blade entire, smooth margin, alternate in a plane, without true stipule, leaf stalk is short, sinuous.

The blade with a yellow mid-rib or with a yellow cast, and especially drying yellow or black, aluminum accumulator.

Multiple axillary buds, twigs often green, discrete shoot system of four or so leaves, abortive terminal bud, axillary buds (often multiple) with odd axillary coverings, scales, together they create a characteristic 'twiggy' branch arrangement with prominent scars.

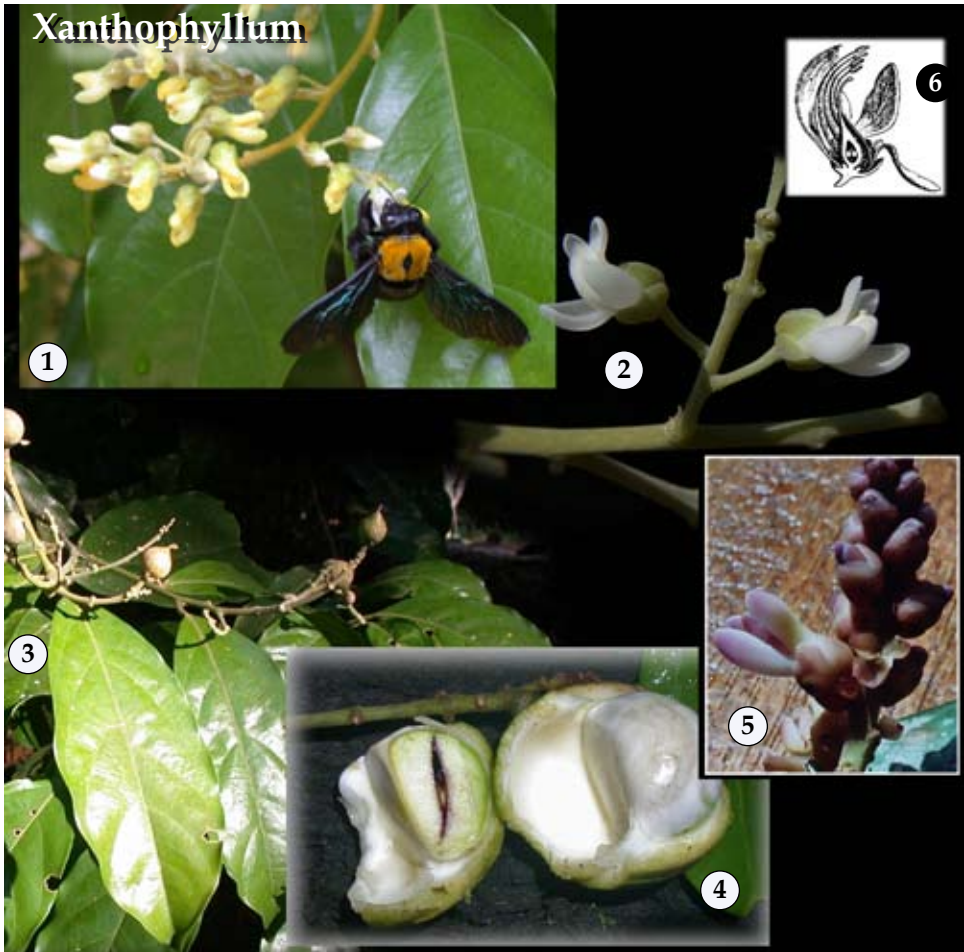
Twigs, bark and wood have a peculiar sour oily odor.

Almost all species have ring-shaped glands in the leaf blade, especially near the apex of the leaf stalk and in the lower part of the blade near the mid rib.

¹Persson, C. 2001. *Taxon*. 50: 763-779.

²Erikson, B. *et al.* 2006. The Families and Genera of Vascular Plants. 9: 345-363.

³van de Meijden, R. 1982. *Leiden Botanical Series*. 7: 1-150.



Xanthophyllum. 1-3, *X. affine*, Pasoh, Malaya, inflorescence, flower and fruit; 4, fruit of *X. lanceatum*, Vietnam, about 3 cm across, 2 or 3 hard seeds covered in fleshy white aril; 5, dense floral stalk and violet petals of *X. adenotus*, Lambir, Sarawak; 6, drawing of flower form. (Drawing 5, from BAILLON *loc. cit.*)

FIELD CONFUSION

The most common error is to misidentify these as *Drypetes* and vice-versa (cf. especially *Drypetes xanthophylloides* of Borneo). The bark can be similar, the yellow wood can be granular in both, the twigs can be green, and the leaves can be without stipules - always in *Xanthophyllum*, sometimes in *Drypetes*. *Drypetes* spp. have one or more of the following features never found in *Xanthophyllum*: stipules, asymmetric leaf base, toothed leaf margin. And in *Xanthophyllum* the twigs are sympodial in construction.

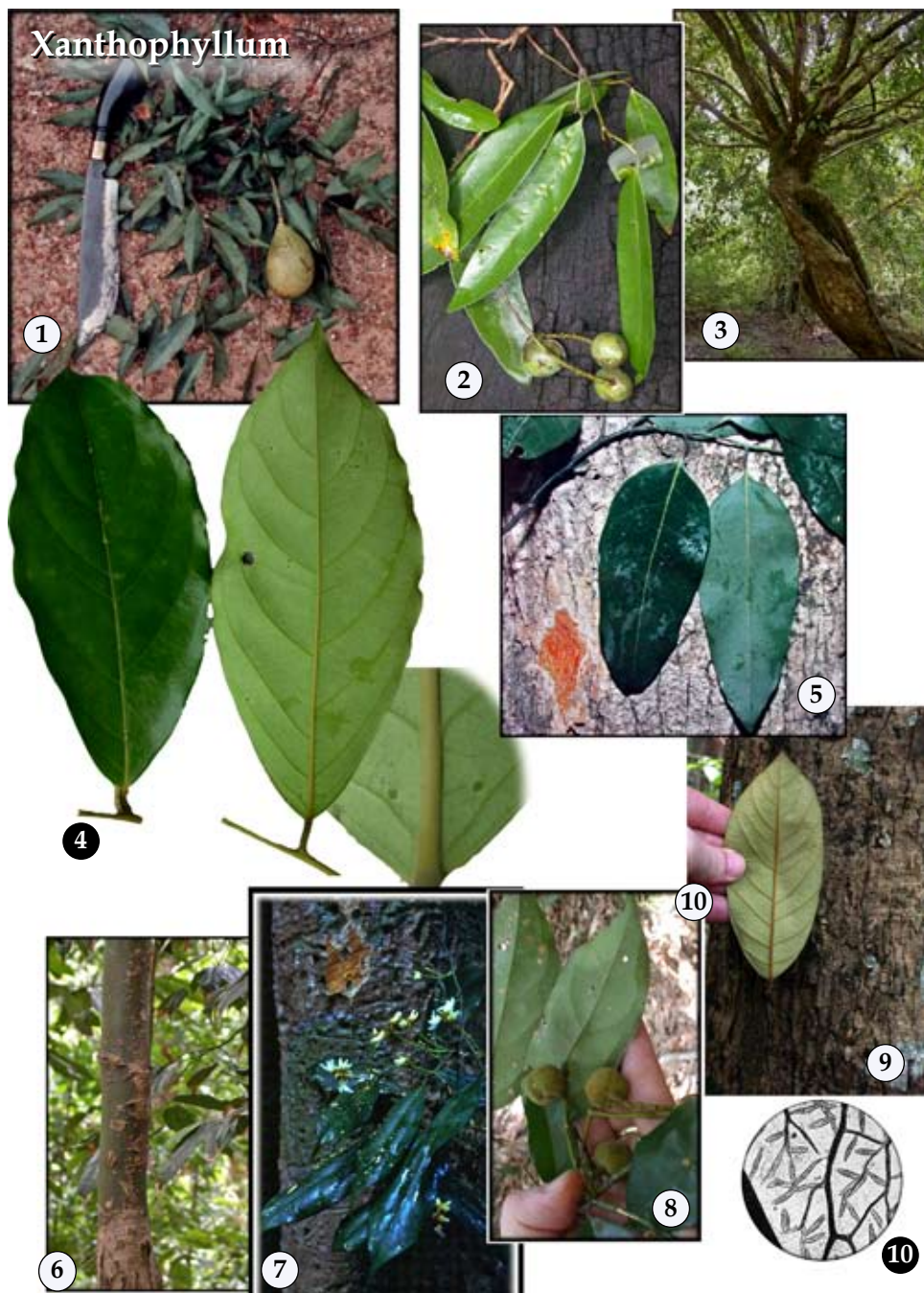
Cleistanthus (Euphorbiaceae), has Phyllanthaceae branching, ordinary lateral twig construction and lacks laminar glands.

Cryptocarya (Lauraceae), with very short leaf stalks and alternate leaves.

The leaf and twig in outline might be mistaken for a *Diospyros* but the ebonies can be distinguished by their whorled branch arrangement, the twigs long with numerous leaves of variant size, the black twigs and white wood, and the leaves when dry are almost never yellow. The glands in the leaves of Ebonies are rarely of the ring sort that is typical in *Xanthophyllum*.

XANTHOPHYLLUM. [Greek, yellow-leaf, the color of the dry leaves.] About 100 species of tropical Asia from India to Australia but strongly centered in richness in the everwet parts of Borneo³, with greatly diminished abundance and diversity in the dry seasonal parts of tropical Asia, and also with altitude, especially above 500 m. About 42 species in Borneo, 30 species in Brunei, 11 on Kinabalu, 27 in Malaya, perhaps only four in the Philippines north of Mindanao, but five others in Mindanao and Palawan; likewise, about 13 endemic to Mainland SE Asia and another five are shared with Malaya. China claims four species, two endemic. Where the trees are abundant they have fairly well established names: *minyak-berok*, monkey-oil in Malaya; the Iban *nyalin* or a variant (*menyalin*, *penyalin*) is common in Borneo. Tagalog speakers are less familiar with the trees but *bok-bok* is reported by MERRILL *loc. cit.*

Most species of *Xanthophyllum* reach maturity between 10 and 20 cm DBH and rarely exceed 20 m



Xanthophyllum. 1, *X. chartaceum* at Pasoh, with large pear-shaped fruit; 2-3, *X. lanceatum* from Vietnam, inundated forest, a short tree, but of large diameter, a malformed twisted trunk, the narrow lanceolate leaves and fruit; 4, *X. affine*, a widespread and heterogeneous species, the population at Pasoh was uniform in leaf form and especially in the presence of paired glands on each side of the midrib; 5, *X. flavescens* in western Thailand, the bark and yellow-orange wood characteristic of the genus; 6-8, the common *X. eurynchum*, flower and fruit at Pasoh, the warty gray bark of older trees, young trees with dark green bark (6, from Singapore), the wood orange-yellow and granular; 9, *X. rufum* from Sarawak with a feltish lower surface, the bark ordinary; 10, a drawing of the odd swollen xylem cells in the cleared leaf. (10, drawn from photomicrographs in Dickinson *loc. cit.*)

in height. A few species are small arching trees no more than two m tall, while the largest diameters are between 50 and 60 cm DBH. However, even these larger trees are never very tall. In species of small stature, the bark is often black-green, whereas many of the larger-statured trees have a characteristic bark of pale dirty gray strongly blistered and warty, the wood yellow oily and granular, and looking very much like *Drypetes*.

The leaves are initiated in a spiral arrangement, but by torsion become alternate in a plane. The node is without stipules but with the axillary buds (typically two or more) that are covered in paired scales, and these in a few species become very large and appear as stipules. The form of these axillary scales and buds are species-specific and an important key to identification. The twigs are typically green, growth is strictly episodic with abortion of the terminal apex and sympodial replacement from buds axillary to the ultimate leaf, and typically leaving a circular scar at the point where the former resting bud had been. The leaf blade is mostly waxy dark green, drying yellow or green (indicative of aluminum) typically with laminar glands, scattered or at the leaf base in pairs.

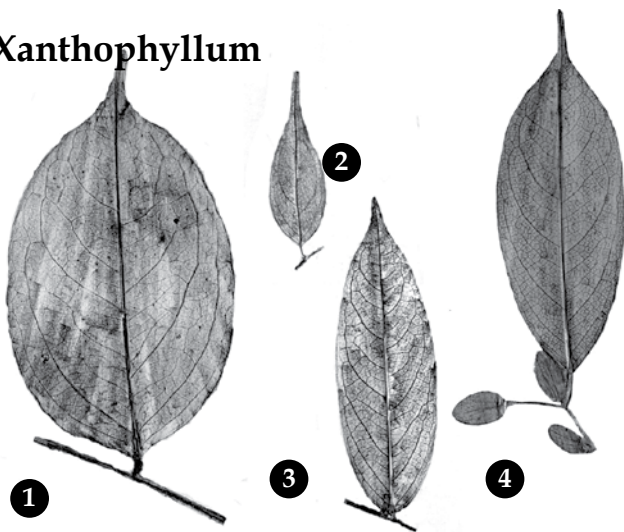
The inflorescence is a raceme, basically axillary, but typically near the twig tips and so appearing to be terminal.

The genus is oddly characterized by an evolutionary play in the development and form of axillary buds. Most typically there are two buds, closely appressed, and each covered by a pair of tiny scales. In some species the buds number four or five in a row, in others they are supra-axillary, and might even reach a leaf-opposed position. In a few species, the first two 'prophylls' are developed in various ways creating a scaled axillary bud, variously sharp and pointed or long and club-shaped, sometimes kicked to the side at an oblique angle, or the prophylls may be greatly expanded as broad thumb-nail shaped stipules, as in *X. bracteatum*.

Peculiar tracheoid cells occur at the ends of the fine veins in almost all species of *Xanthophyllum*⁴. These are greatly enlarged helically thickened cells comparable to the xylem tracheids of the wood, but seemingly misplaced in the leaf blade. In some species they are sheathed with parenchyma cells, in others they appear to be in isolation. Possibly they store waste products of metabolism, but that is entirely hypothetical. No one knows what they do.

These are characteristic trees of the lower canopy in lowland and mid-elevation forests in tropical Asia. At Lambir Hills, Sarawak, the genus was represented by

Xanthophyllum



Xanthophyllum. Variation in leaf size, shape and venation among 4 of 25 species at Lambir, Sarawak: 1, *X. amoenum*; 2, *X. stipitatum*, in these two species (1 & 2) the leaves dry black rather than the characteristic yellow green; 3, *X. beccarianum*, with sessile leaf, slightly invaginated base, hairy twigs; 4, *X. heterophyllum*, with the peculiar paired prophylls of the axillary bud, the related species of the Philippines is *X. bracteatum*.

25 species, at Pasoh by 10 species. A half-dozen or more species would be expected in any particular wet forest and while some might be abundant, few are both widespread and abundant everywhere. *Xanthophyllum euryinchum* may be the most common and widespread species in the Sundaic Region. A group of species, (*X. amoenum*, *X. scortechinii*, *X. chartaceum*, etc.) are unusual in bearing leaves that turn black as they dry. *Xanthophyllum rufum* is notable for the bright reddish hairs of the twig, apex and lower leaf surface. *Xanthophyllum flavescens* may be the most common species in the dry-seasonal forests.

The growth rates are low, never exceeding much more than 2-3 mm DBH per year. Consequently, the wood is very dense and yields a preferred wood for small items like sling shots and tool handles.

Polygalaceae in general are notable for 'bud-self-pollination' in which the pollen germinates upon the stigma, while the flower is still closed. The most recent student of the group, R. van der Meijden, suggested that this process is widespread, which would be remarkable in a zygomorphic flower so evidently designed for bee pollination. Critical studies of pollination biology and population genetics are very much desired here. Trees often bear fruit in abundance and are a favored food for many birds. In a few species the pulp surrounding these seeds is sweet and edible, *X. amoenum*, among them.

The monograph cited above is exemplary, and covers all that can be gleaned from herbarium specimens. Little is to be gained from a second analysis. What is desperately needed now are field studies of almost every

⁴Dickson, W. 1973. Botanical Journal of the Linnean Society. 67: 103-115.

subject, from growth and physiology to pollination and dispersal. The ecological prevalence of the genus and the wealth of fascinating ecology hidden among the species presents for any student in Asia an excellent opportunity for comparative study.

ERIANDRA. [Greek, hairy flower.] Monotypic, *Eriandra fragrans*, a medium-statured tree of New Guinea and the Solomon Islands in lowland forest; curious in its pale and deeply fluted bole. Sepals and corolla basally fused and with one another, the ovary basically eight-locular, the fruit with a few locules containing few seeds enclosed in an aril. (Not illustrated.)

POLYGALA. [Greek, *many-milk* in reference to the reputed property of some species to increase milk flow.] A nearly cosmopolitan genus of about 500 species, almost all are herbs. *Polygala* has its greatest species richness and sectional diversity between southern Mexico and tropical South America with North America and S Africa as secondary centers of speciation, whereas Eurasia, N Africa, and tropical Asia and Australia are poor in species. *Polygala venenosa* is not uncommon in lower montane forests scattered over the Sundaic Region; in those habitats it may grow as a small tree up to 5 cm DBH. It may be more prevalent in the seasonal forests of Philippines and the Lesser Sunda Islands; however, in those places it seems never to exceed 50 cm in height.



Polygala venenosa, here in near-herbaceous form, from Cuernos Mountains, Negros, Philippines. (© Leonardo L. Co.)



ROSIDS (FABIDS): FABALES

FABACEAE

NAME: From the genus *Fabus*, a classical name for beans. The family also appears in older literature as Leguminosae for legume-bearing.

OVERVIEW: If the importance of a plant family is reckoned by a combination of species richness, breadth of distribution, abundance, representation among life

forms, and economic significance, then the legumes easily take the top ranking among all the plant families. Orchids have more species, asters more genera, and grasses probably represent a more critical economic group, while the Dipterocarps are the materially dominant trees of the Asian tropics. But the legumes are exceptional in



Characteristic vegetative features of Fabaceae. Left, strong stipules; right, the swollen pulvinus with strong horizontal wrinkles.

FIELD RECOGNITION: FABACEAE

Highly varied in habit, stature, and bark; rarely with deep thick fissured bark; never resinous nor with white exudate, but red exudate is found in a few genera (*Pterocarpus*, *Callerya*). Many have the odor of green beans.

The leaves are compound, but highly variable in number, size and disposition of leaflets. (See accompanying chart of phylogeny.)

The leaves bear stipules, the leaflet margin is always entire.

The pulvinus at the leaf base is typically wrinkled transversely.

FIELD CONFUSION

Most trees with compound leaves differ in the lack of stipules and/or are arranged in opposite pairs of leaves (as in Bignoniaceae, etc.). Dense upturned rosettes of pinnately compound leaves, as in Meliaceae and Anacardiaceae, is a rare habit among legumes (*Ormosia*). Legumes with once-cut leaves are most similar in habit to Sapindaceae.

Euphorbiaceae such as *Phyllanthus* may look like a *Mimosa* type of legume, but the Euphorb leaves are simple with tiny stipules at each leaf base.

all ways in all places. With totals of 16,400 species in over 600 genera and a distribution from the subarctic to the equator, the family is represented among life forms from annual herbs to woody climbers and huge canopy emergents. The legumes provide valued timbers, key vegetable crops, ornamental flowers, and play a critical role in the natural cycle of nitrogen.

The Fabaceae may be briefly characterized as follows. The leaves are variously compound, from tri-foliate to once or more pinnate with or without a terminal leaflet, the leaflets opposite or alternate along the rachis (exceptionally they are simple or more often compound with one leaflet). Stipules are most often conspicuous. The flowers of legumes are typically bisexual, with flower parts in fives. The details of perianth and androecium vary according to clade, but the gynoeceum is solitary with numerous ovules arranged alternately along the carpel margin, the mature fruit typically dry, splitting down both sutures, but variously modified.

The Fabaceae enjoy a wealth of literature owing to their great economic significance. An on-line nomenclatural database is available¹, as is a recent summary of all known species². The series *Advances in Legume Systematics* has continued for twenty years and is now in its tenth volume^{3,4}. Taxonomic treatments for Thailand and *Flora Malesiana* provide a good starting point for regional study^{5,6,7}.

No traditional plant family illustrates so well as the Fabaceae the recent revolution in plant systematics. Consider the summary opinion expressed by Arthur Cronquist in 1988, "The existence of the three major groups, here called families [Caesalpinaceae, Mimosaceae, Fabaceae] which collectively constitute a larger group, here called an order [Fabales], is widely admitted. It is only the taxonomic rank of the groups on which opinion remains sharply divided."⁸ Twenty years later, the reality of three main groups is thoroughly rejected, while the question of ranking is no longer a matter for serious division of opinion. Even so recently as 1992, the scholarly authority Ivan Nielsen expressed the view that, "Most of the fundamental work [on Mimosaceae] by George Bentham [in 1875] is still valid, at the tribal

as well as generic and species level."⁷ Contrast that opinion with the assertion by Melissa Luckow in 2003 that "None of the tribes of Bentham . . . are monophyletic on a strict consensus tree."¹⁰

The following presents a short summary of the current views on legume phylogeny, although students are strongly encouraged to see the most recent studies reviewed in STEVENS *loc. cit.*, and also to see the highly readable introduction to the family's phylogeny by Doyle and Luckow¹¹, and the summary of molecular phylogeny by Wojciechowski¹².

The basal groups among the legumes appears to include the redbuds (the genus *Cercis*, shrubs of North America) and the tropical trees and lianas of *Bauhinia*. The next clade was formerly a tribe called Detarieae after a regionally unfamiliar genus *Detarium*, but we might better refer to it as the *Cynometra* group. These are exceedingly important genera among the forest trees of tropical Asia, and include *Saraca*, *Sindora*, *Cynometra*, *Intsia* and *Azelia* among others. All of these genera bear strictly opposite leaflets without a terminal leaflet, the individual blade strongly asymmetric. A few of our genera (*Crudia*, *Kingiodendron* and *Pseudosindora*) bear alternate leaflets. In linear order, I next place the genus *Dialium*, which is an odd legume in many respects and its relationships are uncertain. The former subfamily Faboideae is monophyletic with a new and complex internal structure. Among the trees of tropical Asia, we find only a few species of Faboideae that represent only three of the many different constituent clades. Next I list the poorly resolved residue of the old *Caesalpinia* subfamily; it is sometimes called *Caesalpinioideae sensu stricto*, but it still seems to be paraphyletic and will likely be further divided. The Mimosoideae are not at present strictly monophyletic, and some of the former *Caesalpinioideae* may have to be included here in the future. Internally, the Mimosoideae is in great flux; the former tribes based on *Inga* and *Acacia* are interdigitated. A few additional points are made later within the context of the Mimosoideae and Faboideae themselves.

One further point to bear in mind is that the organization of the Fabaceae, while slowly coming together as a series of clades, is still not sufficiently resolved so as to name the clades with uniform rank, a situation in contrast with, for example, the Malvaceae, where the clades are treated as nine subfamilies. Consequently, the groups listed here represent varied former ICBN rankings such as subfamilies for Faboideae, tribes as Detarieae and subtribes as in Dialiinae.

The new phylogenetic view of the family is rapidly changing the former ecological perspective, and this is especially true of the lowland rainforest¹³⁻¹⁶. Too often in the past, the Fabaceae were viewed as monolithic and uniformly important in all lowland tropical forests of the world. From a phylogenetic view, that is not quite accurate. A few points can be made from a brief comparison of trees at Yasuni Forest in Amazonian Ecuador with plots from Pasoh, Malaya and Lambir, Sarawak. First, we note the overwhelming importance of Fabaceae

¹International Legume Database and Information Service (<http://www.ildis.org/>).

²Lewis, G., *et al.* (eds). 2005. Legumes of the World.

³Polhill, R., *et al.* (eds.). 1981. *Advances in Legume Systematics*. 1.

⁴Klitgaard, B., *et al.* (eds.). 2003. *Advances in Legume Systematics*. 10.

⁵Larsen, K., *et al.* 1985. *Flora of Thailand*. 4: 1-129.

⁶Nielsen, I. 1985. *Flora of Thailand*. 4: 131-222.

⁷Nielsen, I. 1992. *Flora Malesiana*. 11: 1-225.

⁸Ding Hou, *et al.* 1996. *Flora Malesiana*. 12: 409-730.

⁹Cronquist, A. 1988. *The Evolution and Classification of Flowering Plants*. pg. 371.










¹⁰Luckow, M., *et al.* 2003. *Advances in Legume Systematics*. 10: 197-220.

¹¹Doyle, J., *et al.* 2003. *Plant Physiology*, 131: 900-910.

¹²Wojciechowski, M. 2003. *Advances in Legume Systematics*. 10: 5-35.

Phylogeny of Fabaceae

The chart below presents an overview of the Fabaceae, the main groupings, their phylogenetic relationships, main characteristics, their global as well as local distribution. The phylogeny generally follows STEVENS *loc. cit.*, which should be consulted for a review of the extensive recent molecular evidence on phylogeny. The linear order is followed in the text and emphasizes the wide separation of genera formerly associated in the former subfamily Caesalpinioideae

GROUP	LEAF FORM	DIVERSITY & DISTRIBUTION	TREES OF TROPICAL ASIA
 <i>Bauhinia</i> Group	 simple 2-lobed blade	Scattered, <i>Cercis</i> in N America), <i>Bauhinia</i> pantropical	Chiefly lianas in tropical Asia, exclusively so in the Sundaic Region, a few trees in dry-seasonal lands.
<i>Cynometra</i> ( once-cut, with mostly opposite, large asymmetric leaflets	82 genera, 750 species, pantropical.	About 14 genera and more than 30 species, important among larger trees, including <i>Sindora</i> , <i>Cynometra</i> , <i>Saraca</i> , <i>Intsia</i> , <i>Afzelia</i> .
<i>Dialium</i> Group	 Sapindaceae-like		<i>Dialium</i> ,
<i>Fabus</i> Group (Faboideae)	 oce-cut with a terminal leaflet or tri-foliate	476/13855, world-wide, especially herbs, tropical lianas, Neotropical trees.	Many genera of shrubs and small trees, especially dry-seasonal (<i>Erythrina</i> , <i>Butea</i>), uncommon among larger trees of equatorial forests, <i>Ormosia</i> and <i>Callerya</i> .
(<i>Caesalpinioideae sensu stricto</i>)			
<i>Cassia</i> Group.	 Variously once or twice-cut,	160/1930	Especially <i>Cassia</i> , dry seasonal forests, forest margins and gaps.
<i>Koopassia</i>			
<i>Caesalpinia</i> Group.			
<i>Mimosa</i> Group (Mimosoideae)	 feathery twice-cut, or with 1-2 pinnae, large or small leaflets, often with glands on the rachis.	82/3275, especially tropical woody.	

in the Neotropics where the family routinely ranks first in all categories. At Yasuni Fabaceae comprised 15% of basal area, 13% of trees and 9% of species of trees. In the two Asian forests, where the Dipterocarpaceae makes up 50% of basal area, the Fabaceae are represented by only a modest fraction of the abundance and richness of the Amazon. This is especially notable at Lambir, which otherwise competes with Yasuni for the title of world's most species-rich forest, each with over 1000 species. The second point is that the representation is not uniform among major clades. The Detarieae are notably rich in Asia, especially at Pasoh. The Asian forests conspicuously lack the rich and abundant large Faboideae. Especially significant is the dominance of the Mimosoideae in America, exemplified by more than 30 species of *Inga*, evidently the result of a geologically recent diversification. We have no parallels in Asia, where most of the Mimosoideae (*Archidendron*, *Adenanthera*, *Albizia*) are strong light demanding gap specialists.

Looking at the composition of Yasuni from an Asian perspective, I might mention one other point. Many significant genera in the Fabaceae are transcontinental, perhaps more than any other family (cf. Myristicaceae or Euphorbiaceae). However, the several genera that Yasuni shares with Asia, such as *Bauhinia*, *Pterocarpus*, and *Erythrina*, would never be found in the lowland equatorial forests of Asia, but rather are expected only at higher

latitudes in places with a long dry season. Indeed, I believe that there is no genus of trees in the Fabaceae found exclusively between forest of the Sundaic Region and tropical America. A complete comparative analysis of the Neotropical and Palaeotropical Fabaceae still remains to be made, but it will have to include the central issue of seasonality.

Approaching 1000 m elevation, trees of the Fabaceae decline rapidly in richness and abundance. The Flora of Kinabalu claims 133 species, but nearly 90% of these are lianas, herbs and exotics. In Doi Inthanon, northern Thailand, at 1700 m, we find a forest dominated by Fagaceae, Lauraceae and Nyssaceae, three families that comprise 50% of basal area. The Fabaceae are a completely negligible part of the tree flora.

Among woody lianas, Fabaceae are typically among the top ranked families. Included here are a great many *Bauhinia*, but otherwise very few of the old Caesalpinoideae, rather we find many Faboideae and some Mimosoideae.

Nodulation and nitrogen fixation is found especially in the Faboideae and the Mimosoideae, rarely if at all among *Bauhinia* and Detarieae. This ecologically critical feature has evidently evolved in the Fabaceae more than once; the interaction with ectomycorrhizae is still to be explored.

The modes of pollination among legumes, and also the modes of dispersal, are so diverse that little can be said of the family in its entirety. Most pollination types are recorded somewhere in the family. Dipsersal is likewise varied. Ballistic dispersal is achieved by torsion of the pod that then bursts open to throw the seeds. Wind is common either from the development of the pod into a wing, or the seeds themselves. Arils are common, although we can note the relative absence in the family of sweet fleshy arils and mesocarps, such as is so prevalent in the Sapindales.

¹³Pennington, R. *et al.* 2004. Philosophical Transactions of the Royal Society. London. B. 359: 1455-1464.
¹⁴Pennington, R. *et al.* 2004. Philosophical Transactions of the Royal Society. London. B. 359: 1611-1622.
¹⁵Lavin, M. *et al.* 2005. Syst. Biol.
¹⁶Lavin, M. *et al.* 2004. Philosophical Transactions of the Royal Society. London. B. 359: 1509-1522.
¹⁷Richardson, J. *et al.* 2001. Science. 293: 2242-2245.
¹⁸Valencia, R., *et al.* 2004. Journal of Ecology 92: 214-229.

	Yasuni, Ecuador				Pasoh, Malaya				Lambir, Sarawak			
	≥ 1	G / S	≥ 30	G / S	≥ 1	G / S	≥ 30	G / S	≥ 1	G / S	≥ 30	G / S
TOTAL	18831	36/106	273	23/55	6585	14/28	251	14/21	4473	11/25	82	9/16
<i>Bauhinia</i>	443	1/2	0	-	0	-	0	-	0	-	0	-
Detarieae s. l.	3604	5/7	15	2/3	2535	4/9	103	4/7	496	2/5	16	2/4
<i>Dialium</i>	97	1/1	7	1/1	877	1/4	29	1/4	520	1/4	15	1/2
Faboideae	1602	14/31	56	10/18	1095	2/4	35	2/2	2623	3/5	12	1/1
Caesal. s. s.	33	3/5	0	-	513	2/2	59	2/2	193	1/2	30	1/2
Mimosoideae	13052	12/60	195	10/33	1574	4/9	24	5/6	642	4/9	9	4/4

Composition of Fabaceae in three near-equatorial lowland forests. The inventory is of all trees ≥ 1 cm DBH with columns in gray for trees ≥ 30 cm DBH. Yasuni is based on a 25 ha¹⁸; Pasoh and Lambir are based on 50 and 52 ha plots respectively, with the tree numbers reduced by half, although the number of genera and species (G/S) are left for the entire plot and so are somewhat greater than would be expected on a 25-ha basis.

☞ - *Bauhinia* Group - ☞

Cercideae

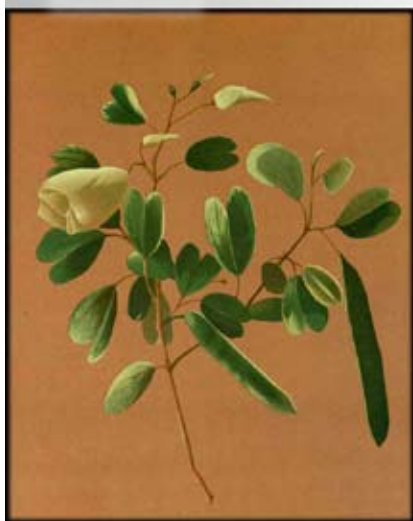
BAUHINIA. [The typical bi-lobed leaves serve to commemorate brothers Jean and Gaspard Bauhin, 16th century botanists.] *Bauhinia* is a pantropical genus of about 150 species, chiefly lianas, with a few species as small shrubs and poorly frmed trees. The treatment for Thailand recognizes 29 native species, eight of which are trees and shrubs; about he same number of shrubs and trees are claimed for the Flora Malesiana region, but in the wet equatorial forests of Malaya and Borneo the genus is exclusively represented by abundant lianas which number more than 60 species.

Bauhinia flowers vary greatly in size, color and organization of the inflorescence. The number of stamens is 10, but reduction to lower numbers is common, some species with five, some with two or only one stamen. The flowers of many species are elegant, glossy with gold and red hairs. The floral diversity is matched by a diversity of pollinators: butterflies, bees and wasps, and in the Americas by hummingbirds with some species in Asia likely

pollinated by sunbirds. A few species flower at night and are pollinated by hawk moths, and some by bats. Among the conspicuous canopy lianas, the flowering within a species is usually synchronous over large areas, the patches of bright orange and yellow dot the canopy.

The best known tree is *Bauhinia purpurea*, originally from India, now cultivated everywhere in tropical Asia for the large violet flowers. The shoots terminate in an inflorescence, the main trunk forms from a succession of lateral branches, each overtopping the last. The fruit gives a good idea of the large flat woody pods that characterizes the genus. *Bauhinia variegata* is a sometimes abundant small tree of deciduous forests of Mainland SE Asia. *Bauhinia binata* is found from the coasts of the Philippines to Australia; dispersed by floating fruit. The only *Bauhinia* with a single stamen is the white flowered cultivated species *Bauhinia monandra*. Although the type specimen of this species is designated as a 19th century Myanmar collection, it almost certainly originated in the Neotropics, where the character state of a single stamen is otherwise restricted.

Bauhinia



Bauhinia. Left, *B. binata*, a small tree of the Philippines; right, the leaf and flower of *Bauhinia purpurea*, here, cultivated in the Philippines. (Illustration adapted from BLANCO *loc. cit.*)

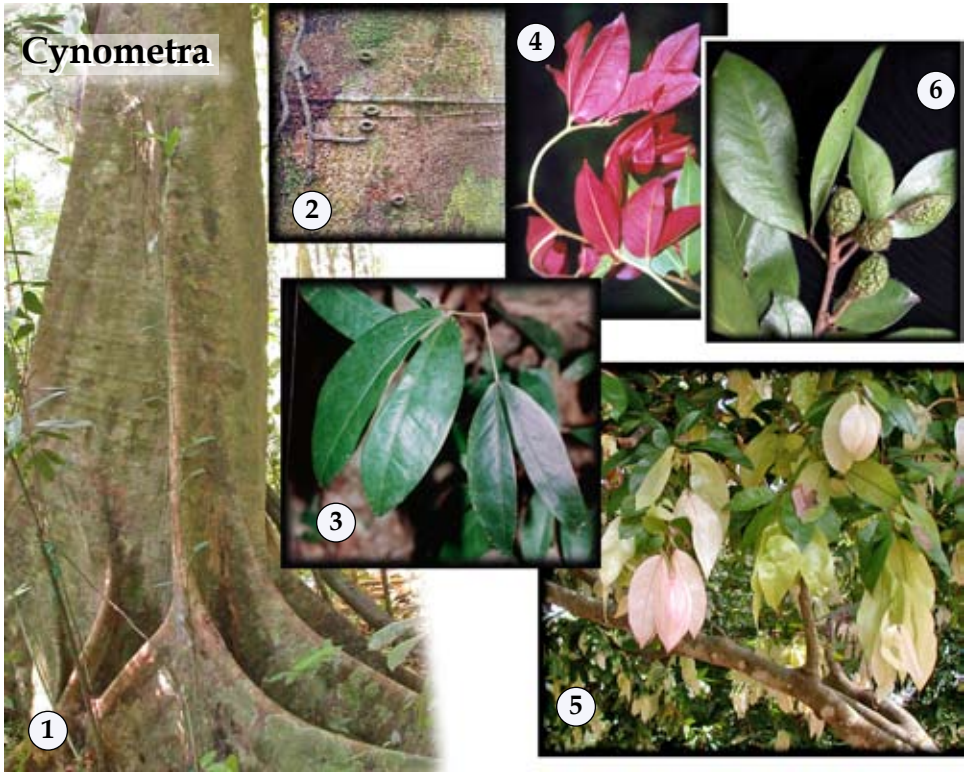
☞ - *Cynometra* Group - ☞

The *Cynometra* Group, Detarieae in the broadest sense, is pantropical in distribution and consists of 82 genera and about 750 species, with the majority of genera confined to Africa and Madagascar. Mo-

lecular data has helped define the circumscription of the group, but the internal structure requires further sampling^{13,14}. In Asia, it is represented by 11 genera, equally abundant as a group in dry-seasonal forests and in the lowland wet equatorial forests. The leaves are pinnately compound with opposite leaflets, without a terminal leaflet; the leaflets are typically asymmetric. Most species are thought to be ectomycorrhizal and non-nodulating, the new leaves typically flush white.

¹³Bruneau, A. *et al.* 2000. *Advances in Legume Systematics*. 9: 121-149.

¹⁴Bruneau, A. *et al.* 2001. *Systematic Botany*. 26: 487-514.



Cynometra. 1-3, *C. malaccensis*, Malaya, distinctive in the gray bark and buttressed bole with small ring-like 'eyes' on the side of the trunk (2), and the asymmetric pairs of leaflets which flush red; 5-6, *C. bipinnata*, Philippines, the new leaves flush white; 6, the fruit is a wrinkled 1-2 seeded bean.

CYNOMETRA. [Greek for dog's womb, translation of a Malay name, *puki-anjing*, in reference to the fancied resemblance of the asymmetric leaflet-pair.] Perhaps no more than 70 species have been described by more than 160 basionyms. Many species are found in South America, but at least a few species occur in all tropical lands. Tropical Asia claims perhaps 30 species including about 10-20 from New Guinea and Queensland treated in the genus *Maniltoa*, a genus distinguished from *Cynometra* by flowers with 15-30 stamens. Many of these *Maniltoa* also have names under *Cynometra* including the only widespread species, *Cynometra* [*Maniltoa*] *polyandra*, which is found from India to Mainland SE Asia southward to N Malaya. It is vegetatively similar to *Cynometra malaccensis*. But note *M. plurijuga* - evidently with 10 stamens - and bears leaves that look much like the eccentric Philippine species *Cynometra copelandii*.

These are typically medium-sized trees with a few paired and strongly asymmetric leaflets, four reflexed calyx segments, five medium-sized white or yellow petals, 10 quickly deciduous stamens, and a thick one-seeded fruit (always?). The bark is gray and even, at least in some species with characteristic circular rings scattered on the trunk. While most species are readily recognized to genus we also find some species with leaves bearing

more than a dozen leaflets. And beware of *C. simplicifolia* in Luzon, Philippines with a single leaflet.

Several species are common or otherwise notable. *Cynometra iripa* is common in the back mangroves. *Cynometra malaccensis* is perhaps the most common species in the lowland forests of the Sundaic Region. *Cynometra cauliflora*, called *enam-enam* in Malay, is an old-fashioned village fruit tree widely cultivated in former times all over the Sunda Shelf, but not so popular today. *Maniltoa grandiflora* becomes co-dominant in some Pacific Islands.



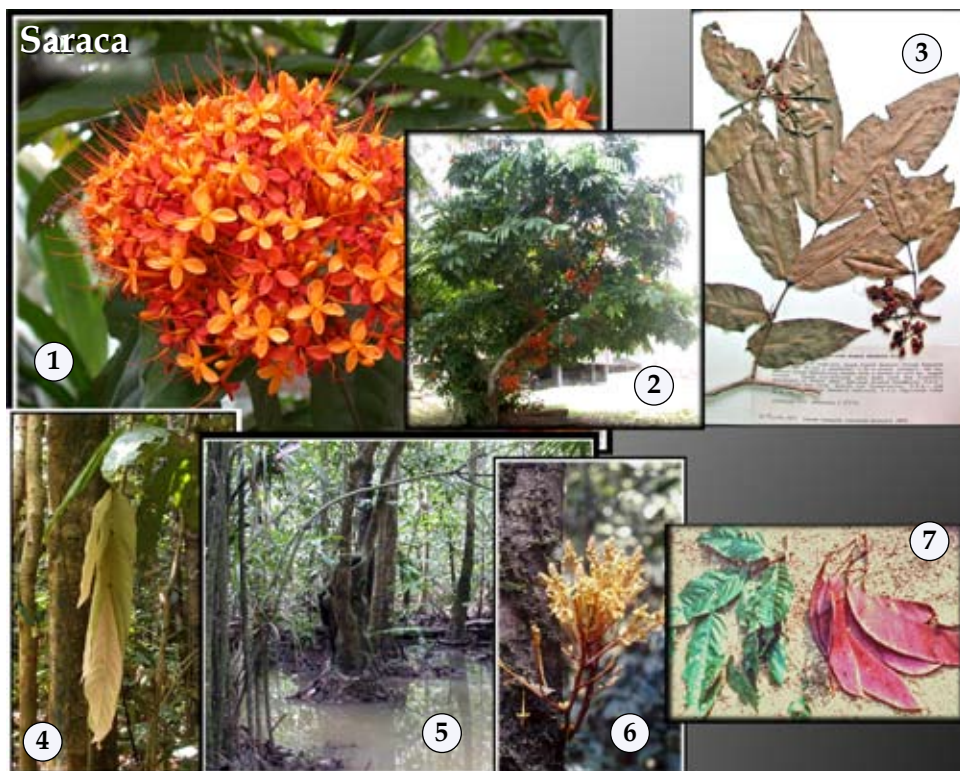
Cynometra copelandii, Philippines, closer to *Maniltoa* in leaf form. (© Leonardo L. Co.)

Although *Cynometra* has a wide ecological amplitude it seems to bear an affinity for water. The leaves emerge white or red, and develop to full size before turning green. When in the immature stage numerous laminar glands are clearly evident, glands that are not so clear in the mature leaf and perhaps function only at the youngest stages. *Cynometra* badly needs a complete reworking from the field and better molecular work, at which point it may be divided into smaller genera.

SARACA. [A corruption the native Indian name for *Saraca indica*.] The genus is found from India to Borneo, Philippines, Sulawesi, and the Lesser Sunda Islands. The Malay is *saraca* or *gapis*; the Iban for *S. declinata* is *de-bai*. The genus is fairly recognizable in the field because the leaves are nearly sessile with the lowermost pair of leaflets positioned immediately adjacent to the pointed terminal bud. The flowers are beautiful, yellow, orange or red, and odd for legumes in that they are without petals, the brightly colored sepals serving to attract pollinators. More than 30 basionyms have been published for the genus and although these are among our most attractive cultivated native legumes, and include the culturally important *asoca* flowers of India, it seems that the number of species, their names and distinctions remain a mystery. As one example of the problem, I note the

ecological range of the trees currently synonymized under *S. cauliflora* (which includes the widely published name *S. thaipingensis*.) The group includes trees that are cauliflorous or ramiflorous, with maximum diameters that range from 10 to 50 cm. In central Malaya they can form 'Saraca forests' along the meandering flat streams, but similar-looking trees are found on hillsides in the Main Range or even far north as Mae Hong Song, Thailand. Among these populations, some trees bear six-eight stamens while in some the number is reduced to four. A similar complex of locally differentiated forms are collected under the names *S. indica* and *S. declinata*.

LEUCOSTEGANE. [Greek, white-covered.] A genus of two poorly known species. *Leucostegane latistipulata* is known only from the original Ridley collection of 1898 in Lumut, Perak, Malaya. A small cauliflorous tree, it was initially called a *Saraca*, and it does have that appearance. Even the enormous stipule-like lance-shaped bracts at the leaf base can be compared to the scale leaves of *Saraca*. The leaves are well-stalked, each leaflet with a small stipel. The petaloid corolla is white with two small petals in the throat. A second species, *L. grandis* is known from Sarawak. (Not illustrat-



Saraca. 1-2, *S. indica* cultivated in the Philippines, the flower is without petals, the colored perianth is the calyx; 3, specimen of *S. declinata*, Pasoh, Malaya, the lowermost pair of leaflets are adjacent to the node; 4-7, *S. thaipingensis*, Pasoh, Malaya, abundant in streams and swamps, the flowers cauliflorous, the large red fruit in clusters on the side of the trunk.



Sindora. 1-5, *S. coriacea*; 1-5, Sarawak, 2-4, Malaya; 2, canopy high and wide, deciduous; 3, canopy with nearly mature fruit sticking up exposed to the wind; 5-7, *S. beccariana*, Sarawak; 5, fallen leaf and flower; 6, mature tree, 95 cm DBH; 7, fallen fruit; 8, *S. velutina*, Malaya, line drawing from voucher specimen, showing leaflet shape and prominent stipules. A variant form of *Sindora siamensis*, perhaps better called *S. maritima*, fruiting at a height of less than 4 m, seaside in central Vietnam.

ed, but see the images of type specimen at the Singapore Botanical Gardens web site.)

SINDORA. [From a native name.] *Sindora* is a genus chiefly of tropical Asia, with perhaps 20 species, although a single species is recorded for Africa. Only three are noted for Thailand, five to seven in the Sundaic Re-

gion with two species found as far north as Luzon, Philippines, chiefly along the east coast. The Malay name *seperti* applies to both the tree and the timber, while in Borneo the Iban name is *tampar*. The name *kayu-galu* is common in southern Philippines.

The leaflet of *Sindora* is characteristic with the strictly paired asymmetric shape; the venation of the leaves is



Sepetir wood, *Sindora* sp., from a wood sample by the Sarawak Timber Council.

very fine and reticulate with the larger nerves entering directly into a collecting nerve in the leaf margin. Each leaf bears a pair of crescent shaped stipules.

Sindora siamensis is a fairly common small tree of Mainland SE Asia, especially prevalent in fire-prone dry deciduous forests. It is commonly noted as bee pollinated. A distinctive variety of that species is a small tree or shrub of beaches and back mangroves of Mainland SE Asia that might be better called *S. martima*. It flowers and fruits at a height of less than four m, bears maroon flowers that are said to be fly pollinated.

In contrast to the small trees of Mainland SE Asia, *Sindora* in the Sundaic Region are big beautiful trees that rise straight from the ground as a great gray column with smooth tight bark and clear hoops. Most species seem to be at least shortly deciduous. The several species differ in relatively minor features of leaf and fruit. The pollination system of the taller trees is unknown although bees are often mentioned as visitors. In most of the tall trees of the lowland forest, the seeds are flat, dry and wingless, but the fruits stick up above the canopy and themselves function as a clumsy sort of wing. Typical of that habit, the fruits often disperse poorly and then persist in great numbers near the tree's base. A dense circle of saplings then follows which leads to a population structure similar to many dipterocarps. The individual adults are scattered rather than clumped, and seem never especially abundant. Nonetheless, *Sindora* is a consistent element found in almost all lowland equatorial forests.

The growth rates of forest grown trees is relatively high. For *S. coriacea* at Pasoh, Malaya, trees between 15 and 30 cm DBH grew at rates up to one cm DBH per year.

In former times, *Sindora* was tapped for a resinous oil. These beautiful trees should be much more commonly grown in city gardens or wherever their ultimate size would not pose a problem.

INTSIA. [From a Malagasy word that the collector erroneously took to be the name; see Baines, *Australian Plant Genera*.] A small but significant genus of three species found from Madagascar to Australia. They are presumed to be sister to *Azelia* differing in the three fertile stamens and seeds that lack an aril. But in vegetative appearance and wood quality they are similar. *Intsia palembanica* is one of the most consistent elements in the lowland Malayan forest. These big trees with plank buttresses and distinctive dipped boles are the principle source of the timber known as *merbau*, one of the staples of the Malaysia sawn-timber trade in the late 1970s and 80s. The wood is very heavy and hard, close grained, attractive in color, easy to work and takes varnishes and stains. *Intsia bijuga* is a coastal species, not uncommon in back mangroves, of small to medium stature, reaching perhaps no more than 80 cm DBH, the leaves most often with two pairs of leaflets. The fruits are dispersed by ocean currents. It is widely known among people of the Pacific Islands as *vesi* and was an important tree for ancient canoe builder, and remains one of the most sought after timbers. *Intsia palembanica* at Pasoh showed growth rates of only one mm per year; the age of a 70 cm DBH tree is certainly to be measured in centuries.



Intsia palembanica, Malaya, the columnar bole (27 cm DBH above the buttresses) with bark pocked red and white, and upper left a voucher specimen showing the papery leaflets, paired without a terminal leaflet.

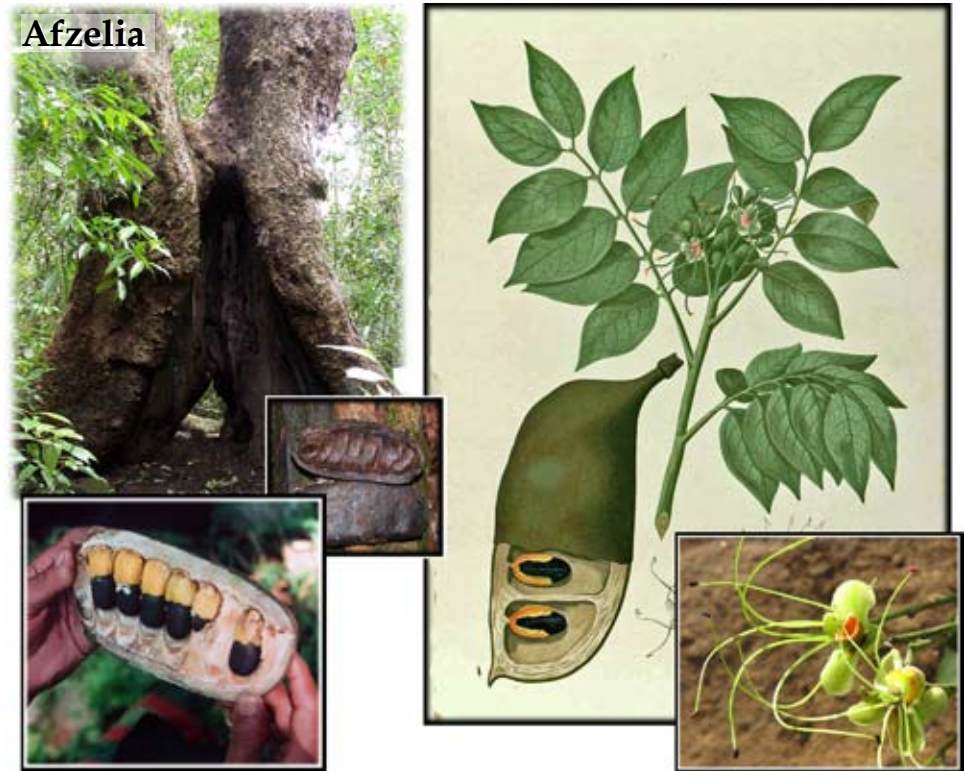


Merbau timber, *Intsia palembanica*, from a wood sample of the Sarawak Timber Council.

AFZELIA. [Commemorates Adam Afzelius, d. 1837, student of Linnaeus, botanist in Sierra Leone.] A genus of 13-20 species, in Africa and Asia, with two species especially notable in our region: *Afzelia rhomboidea* in Java, Borneo and the Philippines, and *A. xylocarpa* of Mainland SE Asia. The genus differs from *Intsia* in bearing seven rather than three or fewer stamens, and in the

thicker seed pod with arillate seeds. In Malay languages it shares with *Intsia* the name *merbau*, while the Tagalog for *Afzelia rhomboidea* is *tindalo*, one of the most characteristic timber trees of the Philippines. These are slow growing trees of seasonal climates. The wood is comparable to that of *merbau*, and is equally regarded as one of the choice timbers for fine furniture. Heavy, hard, beautifully figured in shades of red and brown. The trunk of *Afzelia xylocarpa* is readily recognized in lowland forest of the Mainland because it seems to invariably develop two or three great branches no more than four or five meters above the ground. The flowers are remarkable in the brightly colored flag petal and the extraordinary length of the stamens. I find no record of the likely pollinator although large bees are obvious visitors. The aril-covered seeds are greedily taken by a variety of wildlife and especially by gibbons.

ENDERTIA. [Commemorates F. Endert, d. 1953, senior Dutch forester between 1915 and 1950.] Another monotypic genus, represented by *Endertia spectabilis*, which was only formally described in 1947. This is a large trees, the leaflet blade is pale glaucous below, and as the species epithet suggests, it flowers in profusion. While evidently restricted to eastern Borneo, and some-



Afzelia. Left, *A. xylocarpa*, the typical trunk of a forest grown tree in Vietnam is very large with large branches that fork close to the ground, old fruit pods litter the ground; from Thailand, the arillate seeds are a favorite food of gibbons; right, illustration of leaves and fruit of *A. rhomboidea* in the Philippines, the flower bears exceptionally long stamens and style, the pollinator unknown. (Illustration from BLANCO *loc. cit.*; photograph of flower, © Ulysses Ferreras.)

Endertia



Endertia spectabilis, Bogor Botanic Gardens, the tree sourced in Borneo, the leaflets pale glaucous below, opposite without a terminal leaflet.

times called 'rare', it was found to be the dominant tree in seasonally inundated forests in East Kalimantan¹⁵. The type specimen was taken from a tree cultivated at Bogor.

¹⁵Watanabe, N. *et al.* 2008. Biodiversity and Conservation. 17: 523–538.

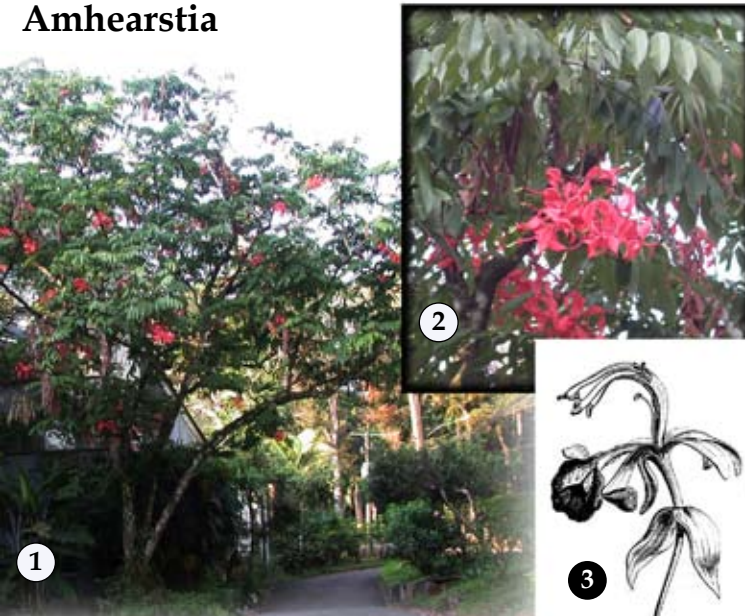
Tamarindus



Tamarindus indicus. Here cultivated in the Philippines, above, pendent thin-walled fruit with sour aril amidst the feathery leaves; below the small but attractive flower, about 1 cm across.

TAMARINDUS. [From Arabic for Indian-Date.] A peculiar monotypic genus, *Tamarindus indica*, the tamarind. The tree is perhaps native to Africa or India, but is now widely cultivated in all tropical lands for the sticky brown sour aril that surrounds the shiny black seed. Sweet-fruited varieties have been selected, the best

Amhearstia



Amhearstia nobilis. Cultivated in the Philippines, line drawing after BALLION *loc. cit.*

are from Thailand, which supplies a significant export market. It is hardy in places with a dry season, and easily withstands urban environments. The flowers are small, but attractive. It sometimes grows casually on roadsides, but is not invasive and perhaps is not entirely naturalized in most of tropical Asia.

AMHERSTIA. [Lady Amhearst, d. 1838, illustrator and collector of Indian plants.] A pantropical genus, represented by *Amherstia nobilis*, with an origin probably in Myanmar, but probably extinct in the wild. It is extensively cultivated throughout the tropics for the red flowers.

CRUDIA. [J. W. Crudy, 18th century collector of plants in the Bahamas.] A pantropical genus with 50 poorly known species, six in Thailand, maybe 13 in Malaya, three in the Philippines. Some species of *Crudia* are of very large size, but our species are mostly small or medium trees of shady forest and freshwater swamps. Typically these are graceful small trees with three to nine leaflets that alternate along the rachis rather than form the strictly opposite pairs as we find in most of our trees in the *Cynometra* group. The leaflet venation is characterized by oddly looped main nerves. The flowers are borne in long lax terminal racemes. The calyx lobes number four, reflexed in bloom, the corolla absent, stamens 10, sometimes reduced to six or less, the dehiscent pods with one-three seeds. The individual species are poorly known in general, but nevertheless may be exceedingly abundant in certain locations. Ecologically, species of *Crudia* are trees of the shady forest that apparently become abundant along forest margins, river banks

Crudia



Crudia. Herbarium specimens, left *C. curtisii* from Malaya, with three leaflets per leaf, and a typical long penent spike-like inflorescence of small flowers; right, *C. reticulata* with a single leaflet, from Sarawak.

and wet forest gaps. In some species the seeds float and are water dispersed. The most recognizable feature is the strongly looped nerves which gives the blade a look very different from most legumes. Be careful with the one-leaflet species such as *Crudia subsimplicifolia* of Borneo and the Philippines; these tend to be determined to all sorts of families; especially compare with the one-leaflet *Ellipanthus* (Connaraceae).

Pseudosindora



Pseudosindora palustris. From swamp forest in Sarawak, trunk of pole size tree, about 25 cm DBH, and leaves of sapling. (Photographs courtesy of Dr. Alex Tuan, UNIMAS, Kuching, Sarawak.)

PSEUDOSINDORA. [Greek, false *Sindora*.] A single, indeed singular species, known in Sarawak as *sepetir paya*, or swamp-*Sindora*, owing to the overall similarity of the trunk and leaflet, and the habitat which is more less confined to swamp forests where it can be sometimes abundant. The original name by Symington was *Pseudosindora palustris*, a good name that I prefer to the transfer made to the well-known American-African genus *Copaiba*. (Much recent literature is under *Copaiba palustris*.) *Pseudosindora* differs from *Sindora* in the stamens, which are evidently 10 in number, equal and free, and differs in the seed which is covered by a bi-lobed aril, and also the alternate leaflets. While these features certainly set the species apart from *Sindora*, there is so much floral pleisiomorphy in the Deteriae that further evidence should be required before it is aligned with such a notable and geographically distinct genus as *Copaiba*. One might expect it in the Johore swamps in Peninsular Malaya, but so far it is not recorded outside of Borneo.

KINGIODENDRON. [Commemorates Malayan botanist Sir George King, d. 1909.] Six mostly locally distributed species, India to Philippines in dry seasonal lands, not in the Sundaic Region. These trees are close to a suite of African genera around *Oxystigma*; also to *Prioria* under which it is sometimes synonymized, although molecular evidence is wanting. *Kingiodendron alternifolium* is found from the Solomon Islands and New Guinea west to the Philippines, where it is widespread from Luzon to Mindanao. It is not especially well-known today, although formerly it was tapped for resin.

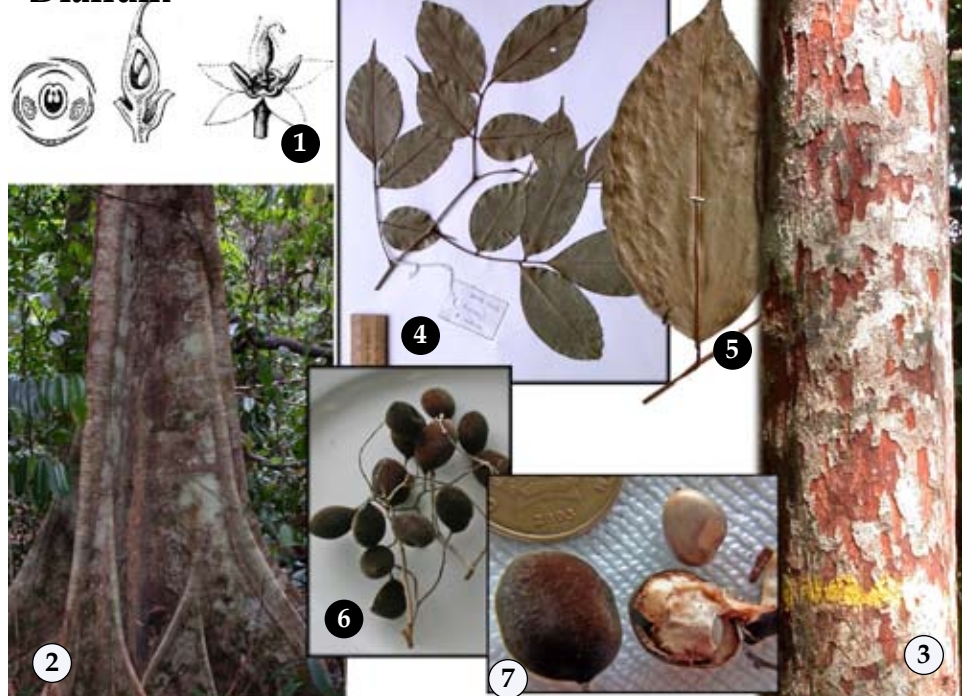
☞ - *Dialium* Group- ☞

DIALIUM. [Linnaean, of curiously uncertain origin, possibly from a Greek plant name, *dialion*.] About 30 species, half in Africa, half in Asia, and the geographically eccentric *Dialium guianense* in tropical America. The genus is abundant in the dry-seasonal parts of Mainland SE Asia, and is also characteristic of the lowland equatorial forests of the Sundaic Region. Curiously, it is not found east of Borneo, nor north into the Philippines, although it might be expected in Palawan and Mindanao. The Malay is *keranji*.



Kingiodendron alternifolium, from Browne., W. Minor Forest Products of the Philippines.

Dialium



Dialium. 1, floral drawings from BAILON *loc. cit.*, of an African species, but representative of the reduced flower with five calyx lobes, petal reduced to one (or none) and only two stamens; 2, the sprawling buttressed trunk of *D. wallichii*, Malaya, 37 cm DBH at a height of about 4 m; 3, trunk of *D. kunstleri*, Sarawak, 21 cm DBH; 4, the leaves, voucher of *D. indum*, large papery leaflets in alternate arrangement; 5, leaflet of *D. maingayi*, the nerves are arched with characteristic fine venation; 6-7, the velvety 1-seeded fruit of *D. cochinchense*, Vietnam, with a thin shell and a thin edible aril, coin 1 cm across, for scale.

These are big wonderful and useful trees that supply fruit, timber, a dense shade and bear an attractive bole. The genus is not hard to recognize in the field: moderate sized trees, up to about 90 cm DBH, with distinct narrow buttresses; the bark is smooth gray or brightly mottled in red and cream patches with a dark red exudate. The leaflets are alternate, almost Sapindaceae-like, sometimes small, thick and yellow-golden (*D. platysepalum*), but often large and papery. The inflorescence is a panicle of small cymes, unusual in the family. The flower of *Dialium* are odd in that the petals are much reduced to claws or absent altogether. It would be hard to recognize *Dialium* as a legumes from the fruit, they might be more easily mistaken as a Sapindaceae. Markets of Malaysia are not often without a big basket of *keranji* fruit, round, about the size of a small plum, with a thin brittle wall, and a sweet or sour aril about the seed. The creamy aril is also dried and sold.

☪ - Faboideae - ☪

The traditional subfamily Faboideae is the most species-rich of clades within Fabaceae. It includes 425 genera and 12,150 species, world-wide, especially in the tropics. These are now grouped in 32 tribes, a number that reflects the great diversity of form and chemistry in this subfamily. In the light of that richness, world-wide distribution, ecological and economic importance, it is remarkable how little of this diversity is represented among the trees of tropical Asia. That poverty is particularly notable in the lowland equatorial forests where we find little more than *Callerya* and *Ormosia* within the canopy layer and a few small understory trees such as *Fordia*. In the seasonally dry forests, the subfamily is better represented by trees of the *Dalbergia* Group. I list 15 native genera, and two common naturalized genera. To this list many more could have been added by relaxing the one cm DBH rule, for many Faboideae are herbs and small short-lived multibranched shrubs such as *Crotalaria*. (The Philippines alone claims 76 genera.) Also, the subfamily includes many of our most abundant lianas: *Millettia*, *Derris*, *Dalbergia*, *Strongylodon* (the jade-vine) *Spatholobus*, and *Mucuna*. Mike Crisp presents a summary portrait of the developing phylogeny of the subfamily, noting about 16 terminal taxa¹⁶. In the list below, I list only three clades: the *Dalbergia* Group, the *Sophora* Group, and the Cavananine-accumulating Clade.

☪ - *Dalbergia* Group - ☪

This is a non-traditional group recently recognized from molecular evidence¹⁷. It includes 44 genera and 1100 species, chiefly American and African. The group significantly changes many past tribal arrangements. The peanut, *Arachis*, is found here;

At Pasoh, many of the trees in the 10-20 cm DBH classes grew at the relatively fast rates of 0.5 cm DBH per year. The forest plot populations were very evenly scattered; recruits were rarely found near the adult trees.

The wood is heavy and hard, and was much sought after for the shipping industry. Singapore supplies were depleted by the time of Cantley's report of 1883. In the 20th century, the *keranji* trees fell into disfavor because of their hardness, and were left behind by logger and farmer alike. Sometimes big trees remain as ghostly relicts in wasteland of Malaya and Borneo.

I believe it is fair to say that no one really understands *Dialium*; its phylogenetic position, basic taxonomy, population biology and economic botany, all remain subjects to which valuable contributions can be made.

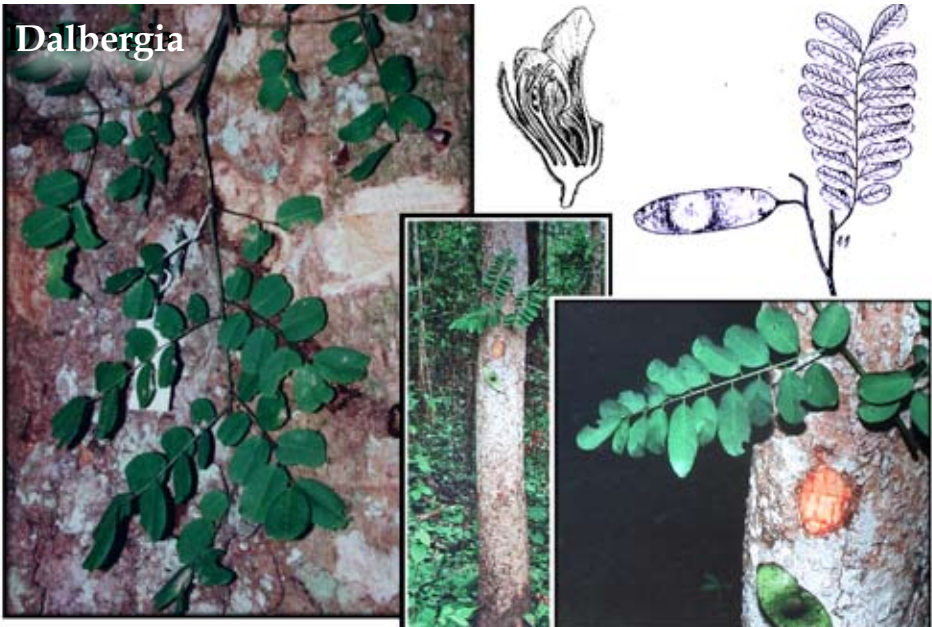
Dalbergia is now widely separated from the *Derris-Millettia* type of Faboideae. Our two main genera in this group have alternate leaflets and indehiscent winged fruit; the group is also characterized by a distinctive type of root nodule that develops adjacent to lateral roots. These trees are most prevalent in the seasonally dry lands.

DALBERGIA. [Commemorates C. Dalberg, d. 1775, Swedish soldier and plant collector for Linnaeus.] Perhaps 100 species, pantropical and subtropical, but the majority are centered in the Himalayas and southern China, growing as trees, shrubs and many species as large woody lianas. The leaflets are alternate, the fruits are thin flat, indehiscent wind-dispersed pods bearing one-five seeds. The big trees provide several of the most famous of hardwood timbers including Brazilian and Honduran rosewood, and the African ebony of antiquity (not to be confused with timber from *Diospyros*). The fragrant timber in Mainland SE Asia is often called Indian rosewood. The genus is poorly represented among trees in the lowland wet forests of the Sunda Shelf, although several species are important big lianas in Malaya. In that ecological and geographic fashion they parallel *Bauhinia*. The flowers and fruit of *Dalbergia balansae* are illustrated in THROWER *loc. cit.*

PTEROCARPUS. [Greek, winged fruit.] A genus of 21 species, pantropical in distribution, but especially important in the strongly dry seasonal forests where it can be a codominant canopy species. The species are most decisively segregated by their fruit, especially the exact placement of the style which varies from apical to basal, and to some extent the flowers. One African species has fruit 16 cm across. Most species are large canopy trees that may exceed one m DBH but are never very tall trees. The crown is dense and the ultimate branches tend to droop. All species bear bright red exudate in the trunk. All have at least tiny stipules that fall away. In

¹⁶Crisp, M. 2009. About Australian Pea-flowered Legumes. (<http://www.anbg.gov.au>.)

¹⁷Lavin, M. *et al.* 2001. American Journal of Botany 88: 503–533.

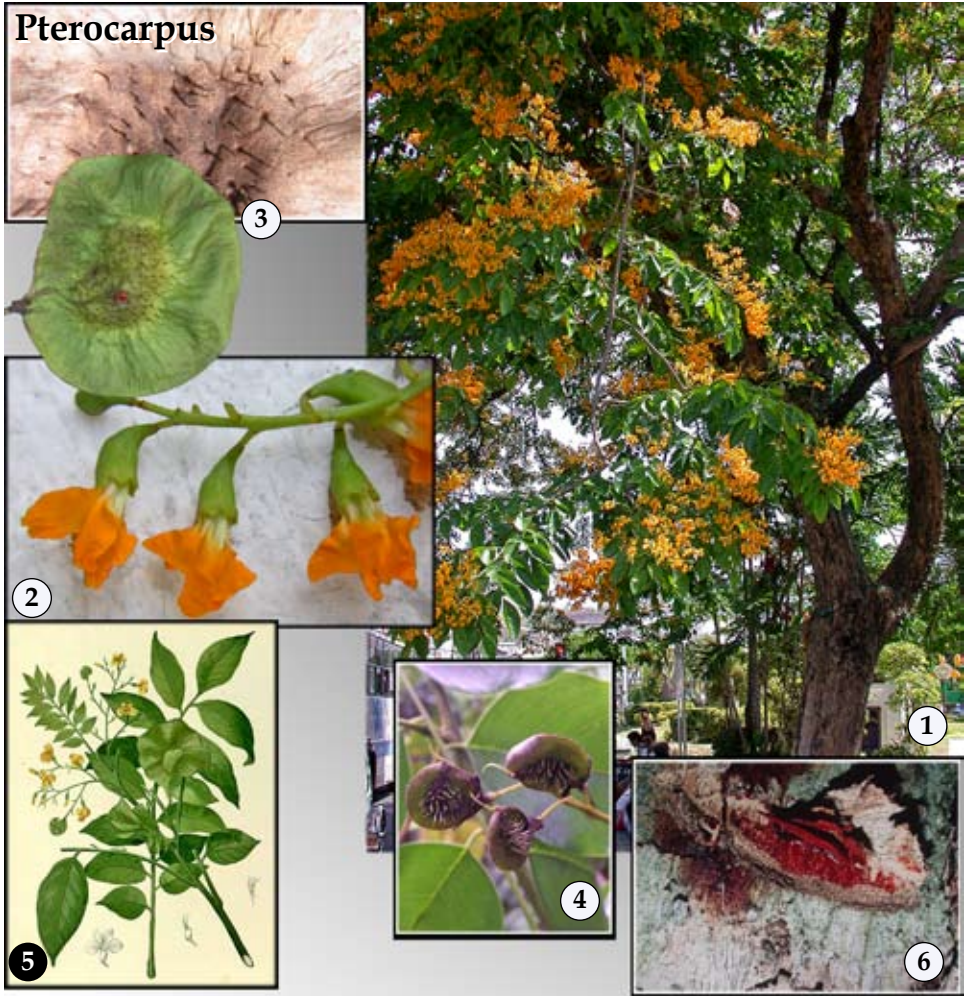


Dalbergia. Photographs are of two species in Huai Kha Khaeng, Thailand, to the left, *D. assamica*; center and right is *D. oliverii*; upper right, leaf and fruit of *D. lanceolaria*, and to the right, the flower of *D. melanoxylon*, an African species. (Leaf and fruit drawing from Brandis, *Indian Forest Trees*; floral drawing from BAILLON *loc. cit.*)

Pterocarpus



Pterocarpus indicus, Philippines, carved wood in the background, the photograph shows the logging of an enormous individual tree, the photograph taken around the start of the 20th Century, Published in Brown, W. *Minor Forest Products of the Philippines*.



Pterocarpus. 1-5, *P. indica*, Philippines; 1, a tree on a city street, dense with fragrant flowers; 2, the flowers are individually small, 3, the fruit, about 3 cm across, with a close-up of the fine spines, and note the drop of red resin; 4, an example of *P. indicus* of the form called *echinatus*; 5, illustration from BLANCO *loc. cit.*; 6, a cut in the trunk of *P. macrocarpus* reveals red exudate, Thailand. (Photograph 4, ©Hazel T. Consunji.)

tropical Asia we have two main species and two others in India.

Pterocarpus indica is *narra*, the national tree of the Philippines and an important part of the forest vegetation throughout most of those islands. It is an abundant native forest species and is also among the most popular cultivated trees of the city. The red oily wood is among the best timbers for furniture and flooring; carved furniture reflects both the Spanish and Chinese heritage. Antique shops still sometimes sell pieces of enormous size, rectangular blocks, 16 feet, by four feet and four inches thick.

The division of *narra* into species has been a long-standing problem in Philippine botany. The fruits vary from nearly smooth to densely cloaked in long soft spines.

The tree is also a popular cultivated species in Malaysia and Singapore where it is called *angsana*, but in those countries it flowers infrequently and is prone to disease. Singapore exploits the species as an 'instant tree' along roadways. Mature trees can be severely pruned, excavated and planted; new branches appear within a month. In Mainland SE Asia, the most important species is *Pterocarpus macrocarpus*.

INOCARPUS. [Greek, fibrous fruit.] A genus of three species, essentially Pacific, represented westward chiefly by the cultivated Tahitian chestnut, *Inocarpus fagifera*. Distinguished by its fleshy fruit, almost equal petals, stamens free or only basally joined. Within our region it is perhaps exclusively found in cultivation. Note

that the leaf is genuinely simple and not a single leaflet of a compound leaf. [Not illustrated, but see the illustrations and description by Pauku¹⁸.]

✧ - *Sophora* Group - ✧

Sophora opposite leaflets. We could add *Dalhousiea bracteata* a shrub from east India to Myanmar (Leaves simple or unifoliate).

ORMOSIA. [Greek, necklace, in reference to the bright colored seeds.] 100 species, including *Placolum*, among others, E South America, tropical Asia to NE Australia. The claim of 23 species in Vietnam is likely excessive; nine in Malaya. *Ormosia* is immediately recognizable from the neat compound leaves in dense clusters, the leaflets strictly opposite and with a terminal leaflet. The free stamens are unusual in the family. Three species in fruit are illustrated in THROWER *loc. cit.* The bright scarlet seeds are unusual and distinct. The ecology of these trees is not clear, but they seem to have the capacity to increase their populations in secondary or ruderal habitats, such as in *kerangas* in Sarawak. Mainland SE Asia includes *O. simplicifolia*.

PERICOPSIS. [Greek, cut around, in reference to the calyx.] Three, important in Africa; in Asia one species, *Pericopsis mooniana*, from Sri Lanka to seasonally dry parts of Sundaic Region, especially lowland forests near the sea, Philippines (Mindanao, Zamboanga del Sur), east to New Guinea and Pacific. The tree is no longer abundant, although it must once have been more

¹⁸ Pauku, R. 2006. *Inocarpus fagifer*. Permanent Agriculture Resources.



Sophora tomentosa, seaside shrub, Palawan, Philippines, above the bright yellow flowers, below the fruit as a string-of-pears. (Lower photograph © Leonardo L. Co.)



Ormosia sumatrana, from Sarawak, the twig is red pubescent and deeply ridged, the leaves with a terminal leaflet, the inflorescence a dense cluster of small pea-like flowers.

common in that the timber is highly valued and traded as *nandu wood*. (Not illustrated.)

SOPHORA. [From an Arabian name.] 45 species of herbs, shrubs and small trees of open places, chiefly in the North Temperate Zone, with a few species into the tropics. Four species in Vietnam. *Sophora tomentosa* is a common shrub on sandy shores of the Pacific, westward into tropical Asia. The genus includes *S. toromiro*, formerly the only large tree of Easter Island, so thoroughly exploited that the native population of trees was finally extirpated.

✧ - Cavananine-Accumulating Clade - ✧

The largest and most diversified group of Faboideae, especially rich in Asia, this group (called the 'Old-World Clade' in Lewis *et al.* cited in the family introduction) is united by the common production of the non-protein amino acid canavanine. The internal structure is changing in the light of many new molecular studies. Most significant is the identification of the strongly supported Inverted Repeat Loss Clade (IRLC), which unites the many temperate herbaceous taxa of economic importance, together with *Afgekia*, *Callerya*, and *Wisteria*, genera formerly misaligned with *Milletia*¹⁹.

ERYTHRINA. [Greek, red for the flower of some species.] A distinctive genus of 112 species, pantropi-

Erythrina



Erythrina. Illustration and photographs of flower and leaves are of *E. orientalis* in the Philippines, sometimes as a variety of *E. variegata*; the thorny trunk to the right is *E. stricta*, Huai Kha Khaeng, Thailand. (Illustration from BLANCO *loc. cit.*; close-up of inflorescence, © Leonardo L. Co.)

cal in distribution, but chiefly in strongly dry seasonal places, with 12 species in Asia, Africa 31, Americas 70. In general, we can see these as trees of India which sometimes have spread east; all four of the native Philippine species are shared with India. Other than the cultivated species, *Erythrina* is uncommon in the equatorial lowlands, and never in the shaded forests. The Malay name is *dedap*.

Erythrina species are fast-growing small trees with spreading crowns and thick heavy and conspicuous inflorescences terminating the branch. The leaves bear three leaflets, the trunk usually spiny. The fruit of our species are mostly flat, papery and with only modest constrictions between the seeds. The floral ecology is better known among the American species than the Asian. In general, it seems that species of Africa, India and Asia are pollinated by perching birds such as the olive-backed sunbirds, the peduncle often long and used as perch, the flower twisted back, the nectar relatively low in sucrose and high in amino acids. By contrast, in some Neotropical species the flower bears an elongated narrow corolla, and exudes high sucrose / low amino acid nectar to take advantage of hummingbirds.

Species of *Erythrina* appear to be especially susceptible to problems in cultivation. Within the last few years, many of the cultivated *Erythrina* in the Philippines have been decimated by wood-boring beetles.



Butea monosperma, here cultivated in the Saigon Zoo, Ho Chi Minh City, Vietnam, the trigloate leaf.

¹⁹Hu, J. *et al.* 2002. Systematic Botany. 27: 722–733.

BUTEA. [Commemorates John Stuart, 3rd Earl of Bute.] *Butea monosperma* is one of the best known of North Indian trees, certainly among the most commonly cultivated in Mainland SE Asia, and one of the most extensively photographed. It differs from *Erythrina* in the spineless trunk, the flower petals are of a more uniform size and the fruit is thick and woody. It can flower before the leaves emerge or just after; it then creates a gaudy show of dense orange-red blossoms. *Butea* may be in part native or it might simply be sparsely naturalized over the centuries of cultivation. A second species, *B. superba*, is a woody liana. Both are extensively used in traditional Indian medicine.

DESMODIUM. [Greek, in reference to the linked-chain like pod.] A species-rich (400-500) genus of more or less weedy herbs, pantropical, but especially E Asia, Mexico and Brazil. A few grow as small trees and shrubs²⁰. In Asia, *Desmodium umbellatum* is among the more common; it is a widespread and abundant plant of seashores, coastal river banks, and dry land adjacent to mangroves. Almost all *Desmodium* species bear tri-foliolate leaves with small pods that break up into single-seeded units infamous for their velcro-like exterior that sticks to pants, socks, hair. CORNER *loc. cit.* notes the Malay names *petai laut* and *lemak ketam*.

FORDIA. [Commemorates C. Ford, 19th century horticulturist in Hong Kong.] 18 Asia, four species in Malaya, two in Borneo and one in Sumatra and one, somewhat doubtful, known only from the type, supposedly collected in southern China and cultivated in Hong Kong. The Iban name is *biansu*. These are small trees of the forest understory; they bear clusters of purple flowers on the trunk and branches. At Lambir, Sarawak, the 52-ha plot, *Fordia* was among the most abundant of understory trees, with nearly 100 trees per ha, evenly distributed throughout the plot. Two species were found at Lambir, *Fordia splendidissima* and *F. leptobotrya*. Molecular data has indicated that they are not monophyletic with respect to the very large residual genus of *Millettia*²¹. The current recommendation is to transfer *Fordia leptobotrya* to *Millettia leptobotrya*, and it may yet move to a reestablished *Imbralyx*.

PONGAMIA. [From a Malabar name] two species, especially *Pongamia pinnata*, sometimes included in *Deris*, recognized by white or pink flowers and round one-seeded fruits, two-pairs of leaflets with a terminal leaflet. A coastal species, resistant to salt and sometimes planted



Desmodium umbellatum (now preferentially in the segregate genus *Dendrobium*); above as a montane shrub in central Vietnam; below as a seaside tree in Luzon, Philippines.

in cities. A distinct variety of this grows inland along rivers. The Malay name is *mempari* or *melapari*. The other species is restricted to New Guinea.

ANTHEROPORUM. [Greek, the anthers dehisce by pores.] About three species, China and south at least



Fordia filipes, Sarawak, a small understory tree, pinnate compound leaves with a terminal leaflet, purple flowers (not shown) and small flat pods.

²⁰Ohashi, H. 1973. Ginkgoana. 1: 1-318.

²¹Hu, J. *et al.* 2000. American Journal of Botany. 87: 418-430.



Pongamia pinnata, on the seashore, Philippines; pale poorly formed trunk, pinnate compound leaves and thick pds.

to the northern parts of Thailand, Vietnam and Laos. (Not illustrated.)

DERRIS. [Greek, leather.] A genus of 40 species distributed from Mainland SE Asia to N Australia; one species as a tree widespread in mangroves from E Africa to the Pacific. The fruit of *Derris* bears only one seed, the pod is thin and winged. Rotenone was extracted from the roots and became one of the earliest plant-sourced commercial insecticides. The species vary in their toxicity. (Not illustrated.)

CALLERYA. [Commemorates J. Callery, French missionary of China.] A tropical Asian genus of 15 species, 13 are lianas. (Flora of China suggests 30 species with 18 in China, 10 endemic.) The leaves bear large and strictly opposite leaflets with a stalked terminal leaflet; the stipules are often obvious, as are the narrowly triangular stipels. The stamens show a nine + one arrangement. The fruit is usually indehiscent with a few large seeds.

Two species are fairly common trees. *Callerya atropurpurea* (long known as *Millettia atropurpurea*) is an abundant tree of lowland forests found widely from Mainland SE Asia to Australia; widely known in Malay as *tulang daing* or bones of dried-fish, perhaps in refer-



Callerya. 1-4, *C. atropurpurea*, Pasoh, Malaya; 1, forest tree, 32 cm DBH; 2, dense carpet of fallen flowers beneath a tree; 3, fruit with thick seeds; 4, flower with young pod, stamens fused except for a single free stamen; 5-7 *C. vasta*, Lambir, Sarawak; 5, forest tree, 58 cm DBH, with inset of fallen leaflet; 6, voucher of leaf and young fruit; 7, flower stalk.

Indigofera



Indigofera, unidentified to species, Vietnam, about 800 m elevation; tree about 10 cm DBH.

ence to the arched nerves of the leaflet. *Callerya vasta* is restricted Borneo where it is fairly consistent on rich wet soils; known as *kedong belum*. This genus is superficially similar to *Milletia* in the climbing habit, the leaf, purple flower, pale bark, red exudate. Molecular evidence separates the two genera.

Sesbania



Sesbania grandiflora, a small tree of Neotropical origin, cultivated widely, especially in the Philippines for the edible hite flowers. (Illustration from BLANCO *loc. cit.*)

INDIGOFERA. [Greek, indigo bearing.] 700, pantropical and warm lands. Mostly herbs and perennials with short-lived branches, many species from India to Indochina, a few large enough to call trees. *Indigofera zollingeriana* can reach 10 m or more tall in the mountains of Vietnam.

SESBANIA. [From a Middle Eastern name.] 50 species, pantropical, especially in seasonally dry places. *Sesbania javanica* is a short-lived small shrub of open places and may be the only native species in the Sundaic Region. *Sesbania grandiflora*, native to India and Mainland SE Asia, is widely cultivated and may be the

most accessible species in the region. The flowers are a popular vegetable and herbal tonic in Mainland SE Asia and also in the Philippines, especially in the northern Ilocos region where the name *katuray* suggests the Indian origin; the Tamil name is *akatthi*. The stamens are bitter and always removed before cooking. The South American red-flowered shrub, *Sesbania punicea*, is scattered in tropical Asia; although attractive when kept trimmed, it has become a serious invasive in S Africa.

Gliricidia



Gliricidia sepium, originally from Mexico, cultivated and widely naturalized, somewhat invasive; a small deciduous tree, that flowers when leafless,

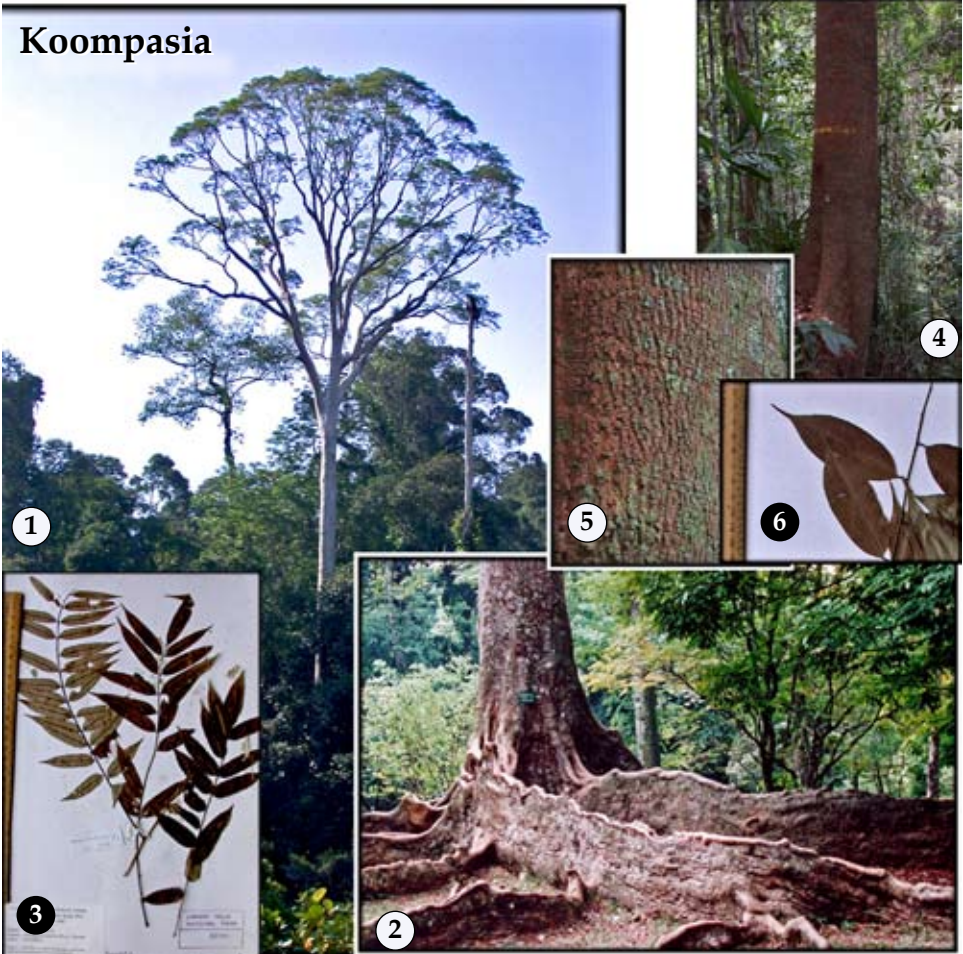
GLIRICIDIA. [Latin *glis*, mouse, and *caedere*, to kill, in reference to the presumed rodenticide properties.] A neotropical genus represented everywhere in the tropics by *Gliricidia sepium*. It was brought from Mexico to the Philippines in early Spanish times. Now used everywhere as an instant tree, any branch stuck in the ground be-

gins to grow. However, they quickly naturalize in any open degraded land. Most often these small trees take on a sparse trashy form, but carefully cultivated they can grow to be passably attractive.

☞ - **Caesalpinoideae** - ☞

The traditional subfamily of Caesalpinoideae is paraphyletic. Most of our abundant large trees are in the *Saraca* Group (Detariae) and removed to a position more basal to the legumes, and *Bauhinia* is likewise split apart. The remaining taxa are still not likely monophyletic and continued future

discoveries about their relationships should be anticipated. The genera are listed here in three groups, the somewhat isolated *Koompassia*, a species-rich group of shrubs surrounding *Cassia* that is poorly represented in Asia, and the remaining genera, perhaps associated with *Peltophorum*. I might have also added *Zenia insignis*, which reaches northern Thailand and northern Vietnam.

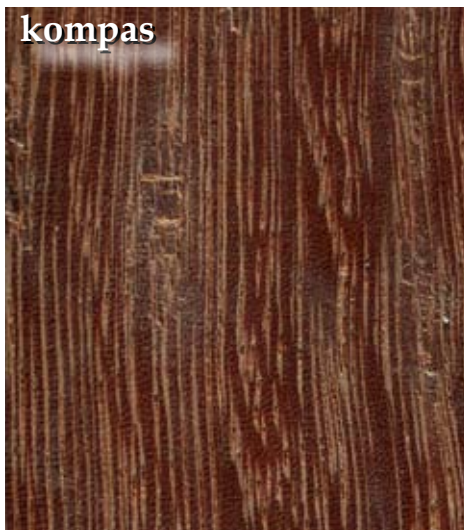


Koompassia. 1-3, *K. excelsa*; 1, mature tree in Sarawak; 2, the spreading buttresses of a cultivated tree in Bogor Botanic Gardens, Java; 3, leaflets of a voucher specimen; 4-7, *K. malaccensis*; 4-5, mature tree in Malaya (4) and Sarawak (5); 6, detail of bark; 7, leaflet of dry specimen.

❖ - *Koompassia* Group - ❖

KOOMPASSIA. [From the Malay name.] *Koompassia* is a singular genus with three species, one in New Guinea and two in tropical Asia. These are among our tallest trees, commonly to 50 or 60 m, rarely to 80 m. The leaves are once-cut with a terminal leaflet, leaflets sub-opposite to alternate, inflorescences are panicles, the flowers bisexual with calyx, corolla and stamens numbering five, the ovary with a single ovule. The fruit is one-seeded, thin, flat, winged, and wind-dispersed. The trees are variably deciduous. The wood is extremely heavy and hard, comparable to *bilian* or a *balau* in weight. Very often these trees are left after land is cleared of other trees and so stand solitary watch along roadsides and near padi fields. To the logger, the hard wood and broad spreading buttresses make felling a challenge, while to the farmer, the high horizontal branches are the preferred home for honey bees. These are among the classic bee trees of Borneo and Sumatra, and the subject of customary ownership laws. Great skill and nerve is required to climb the trees, typically at night and aided by ritual.

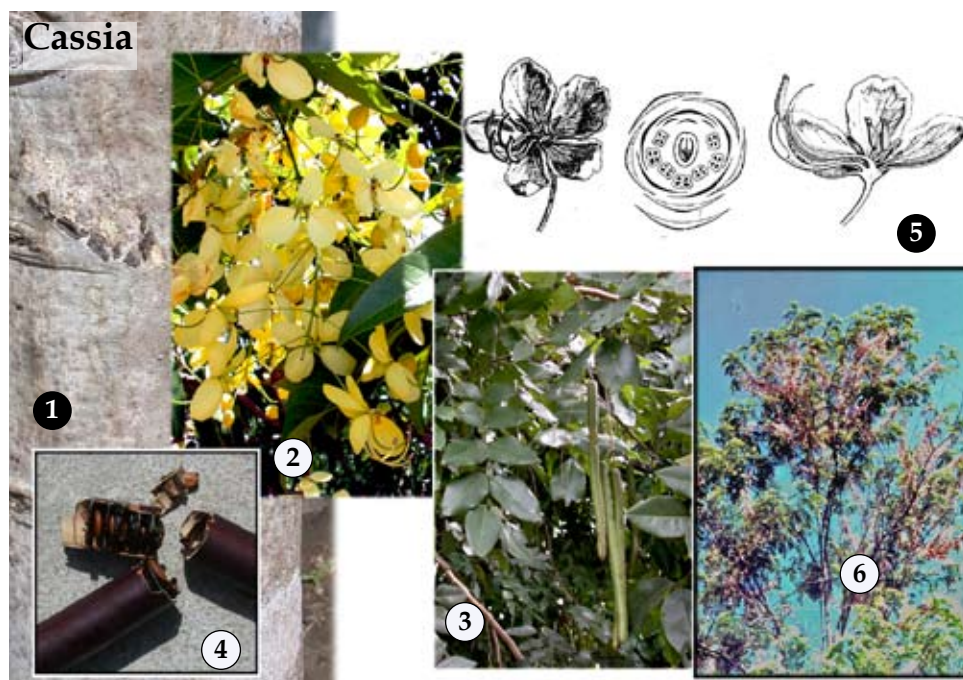
The two species are easily distinguished. *Koompassia malaccensis* is distinguished by leaves are 5-13 cm long and bear five to nine leaflets; the pods to three cm long. The Malay name is *kempas* although it is widely known in Borneo as *mengris*. A species somewhat tolerant of poor soils, it is relatively common on low flat ground,



Kompas wood sample, probably *Koompassia malaccensis*, Sarawak Timber Trade Council, commercial wood sample.

including wet soils, and seemingly unsuccessful on hill slopes and ridges where it is replaced by its congener.

Koompassia excelsa bears seven to 12 or more leaflets, each 3-4 cm long; the pods are 7-8 cm long. It is found most often in hillside forests. The name in Malaya is *tual-*



Cassia. 1-5, *C. fistula*, here cultivated in the Philippines; 1, the pale and cankerous bole; 2, the dense clusters of large golden yellow flowers; 3, the long pendulous pods; 4, the shiny individual seeds embedded in a sticky malodorous pulp; 5, line drawing of the flower; 6, the pink-flowered *C. javanica*, secondary forests in Malaya. (5, from BALLION *loc. cit.*)

ang, in Sarawak *tapang*. Whitmore says it is oddly missing from the Malay Peninsula south of the KL-Kuantan line, but surely it must be in Endau-Rompin. It is well-developed in Borneo, and was recently found in Palawan, Philippines. The buttresses of *tapang* are very long, and uniformly thin, a shape that taken together with the great weight and strength of the wood makes them ideal for tables.

❖ - *Cassia* Group - ❖

This species-rich group was long united as a heterogeneous *Cassia*. During the last twenty years, the consensus view is to maintain three genera, *Cassia*, *Senna*, and *Chamaecrista*. Molecular work to date has not had sufficiently wide sampling to test monophyly and so I simply list the three genera and discuss the species with the names currently in use.

CASSIA. [*Cassia* referred to a substitute or adulterant for true cinnamon bark, but the application by Linnaeus to these legumes is unclear. Many species of *Cassia* were adulterants of tobacco or opium, and the application may follow from this sense.] Usually treated as 300 species, pantropical. Most species of *Cassia*, bear yellow flowers, perhaps the most notable of these is *Cassia fistula*, found naturally from India to Mainland SE Asia, but now widely cultivated in tropical Asia, evidently not naturalized. It is sometimes abundant in the dry deciduous forests of the Mainland. At the end of the dry season

Marazzi, B., *et al.* 2006. American Journal of Botany. 93: 288-303.

the trees, naked of leaves, fill the forest with a marvelous display of dense clusters of pendent yellow flowers.

Other than the yellow-flowered species, we find several pink-flowered species in Mainland SE Asia (illustrated in GARNER *loc. cit.*). Only one, *C. javanica*, gets so far south as central Malaya where it is restricted to secondary forest and large gaps. In Malay it is *busu-busu*, appropriate for the stinking fruit. It is certainly further east, uncertainly native there.

SENNA. [From an Arabic name for the type species.] Of the approximately 350 species currently ascribed to the genus, 80% occur in North and South America, with the remaining species in tropical Africa, Madagascar, and Australia, and only a few species in Asia. (Marazzi on phylogeny) Asian species are without extra-floral nectaries that characterize most species. *Senna alata* is a good accessible representative of the ordinary American type of flower and leaf. Another common American species also widely naturalized is *S. sulfurea*, a name preferred for *S. surattensis*. We have about five to seven native species that sometimes grow as small trees, perhaps no more than five cm DBH. The most abundant is probably *S. timoriensis* of Mainland SE Asia.

❖ - *Peltaphorum* Group - ❖

PELTOPHORUM. [Greek, shield-bearing.] About 15 species, pantropical, two in tropical Asia, both are native to the Mainland SE Asia (minor distribution to Sumatra) and both are widely cultivated, especially in cities where it is easy to grow and hard to kill by urban



Senna. Left, *S. timoriensis*, Thailand, center, *Senna alata*, native American in origin, widely naturalized in tropica Asia; right background, *S. sulfurea* (= *S. surattensis*), invasive weed in Hawaii; upper right, *Senna floribunda*, line drawing of flower. (Drawing from BAILLON, *loc cit.*; photograph of *Senna sulfurea*, by Forest & Kim Starr, Hawaii.)

Peltaphorum



Peltaphorum dasyrrachis, cultivated in Ho Chi Minh City, Vietnam; the yellow flowers clustered above the feathery leaves, the bark with dark wavy fissures, the thin flat seeds are held above the canopy.

neglect. These are small to medium trees, 15-20 m tall; the bark gray with distinctive black longitudinal cracks; leaves twice cut, about five-nine pair, very numerous opposite sessile leaflets about 10-20 X 5-10 mm, with a notch at the apex; the petals yellow about two cm long. In *Peltaphorum dasyrrachis* the inflorescence is lateral and the seeds sit at right angles to the pod; in *P. pterocarpum*, the inflorescence is terminal and the seeds align along the length of the pod.

DELONIX. [Greek, conspicuous clawed petals.] 12 species, chiefly Madagascar, tropical Africa, and India, but *Delonix regia* widely cultivated everywhere in the tropics. The best-known common name is *poinciana*, named for Phillippe de Longvilliers de Poincy who introduced the tree to America. Occasionally you find odd varieties with yellow-orange flowers rather than the usual brilliant vermilion.

ERYTHROPHLEUM. [Greek, red-bark.] About 15 species from Africa and Madagascar to Australia, with maybe three species in Mainland SE Asia, and sparsely in dry-seasonal Indonesia, but not in the Philippines. (The name *Erythrophleum densiflora* was formerly used in the Philippines for a tree that is now in *Sympetalandra*.) The main species is *Erythrophleum teysmannii*, sometimes under the synonym *E. cambodianum*. This is a deciduous canopy tree in open forests to 25 m tall, the trunk with red sap, leaves twice cut, with two-four pinnae opposite, the leaflets alternate and long stalked, the blade four-

eight cm long. Each inflorescence is a spike of small bisexual flowers with parts in fives, stamens 10 with longitudinal slits, much like *Sympetalandra*. The fruit is dehiscent, about 15 cm long. This is reputedly one of the best rough timbers in Mainland SE Asia, strong, straight and resistant to rot and insects. The bark of species in Madagascar is poisonous and for *taguin*; likewise, the seeds of the Cambodian tree are evidently virulently poisonous. (Not illustrated.)

SYMPETALANDRA. [Greek, in reference to the fused petals and stamens.] Sometimes wrongly described as monotypic, now regarded as a genus of at least four species, Malaya, Sumatra (not Java) to Lesser Sunda Islands, Sabah and Philippines. Narrow small flowered spikes. The leaves are typically twice-cut compound, the pinnae opposite, with fairly large leaflets. (Not illustrated.)

CAESALPINIA. [Commemorates Andrea Cesalpino, 16th century Italian botanist.] A once broad and species-rich genus, now reduced to about 25 species 150 tropical and subtropical Africa, Asia, America. The climbers are notable for extensive use as dyes and tannins and some medicinals. In the Americas more species are medium trees. And *C. echinata*, a tree known locally called *pau-brazil*, whose heartwood was exported to Portugal in such quantity that it gave the land of Brazil its name. In Asia, this is primarily a genus of stout thorny climbers that sometimes grow as sprawling shrubs. Leaves are twice-cut, the rachis is prickly, the leaflets are variable opposite or alternate, sessile or stalked, but without a terminal leaflet. The fruit variably dehiscent or indehiscent and winged. The most abundant species of *Caesalpinia* in much of our region are either cultivated ornamentals or species that having been planted for ornament or erosion control became invasive. *Caesalpinia* appear to excel as weedy invasives. *C. pulcherimma* is cultivated wherever there is a strong dry season for the open panicles of orange flowers; *C. sappan* is similar but is most often a dense thorny scrambling shrub with white flowers, while *C. decapetala* has broad leaflets and a dense inflorescences of white flowers.

ACROCARPUS. [Greek, fruit at the apex.] A genus usually treated as a single species, *Acrocarpus fraxinifolius*, of Asian dry-seasonal mountains, from India to Mainland SE Asia, certainly in Sumatra from where the type specimen was collected, and probably native to Java as well, but not further east or north. (Note there are



Delonix regia, the common cultivated poinciana, here in the Philippines.

many false literature citations for its presence in Malaya and Borneo.) A big fast-growing tree, widely cultivated in tropical America and Africa for shade and timber. GARDNER *et al. loc. cit.* illustrates the tree, and claims it reaches a height of 50 m in northern Thailand. Although it is one of the fastest growing of trees and yields a serviceable wood, it is curiously not much grown in tropical Asia. The leaves are twice cut, the leaflets somewhat asymmetric. Briefly deciduous. The inflorescence is a dense spike of bright red flowers.

GLEDITSIA. [Commemorates German botanist J. Gleditsch, d. 1786.] About 12 species, two in E N America (the locust tree, with edible flowers), one S America, one Caspian, maybe 10 in the Temperate Zone of Asia from China to Japan, with a single species, *Gleditsia fera* found in China and Taiwan and then south widely and not uncommonly in the Philippines (as *G. rolfei*) from Luzon to Mindanao and then rarely to Sulawesi (as *G. celebica*); also southward to northernmost Thailand, Laos and Vietnam.

Caesalpinia



Caesalpinia. Here represented by *C. pulcherrima*, a widely cultivated shrub native to tropical America.

Acrocarpus



Acrocarpus fraxinifolius, illustration of leaf and flower, the dense spikes of flowers are red; adapted from WIGHT *loc. cit.*

The legume subfamily Mimosoideae includes about 82 genera and some 3275 species. Although most Mimosoids are quickly recognized by the feathery leaves and small white flowers with valvate petals, the exact limits of the subfamily remain undefined while the internal structure is unsettled. The tribes of Benthham are no longer tenable: *Parkia* is not at all close to the neotropical *Pentaclethra* with which it was once aligned, while the tribes that centered on *Inga* and *Acacia* are interdigitated. The large and formerly pantropical genera *Albizia*, *Acacia*, and *Pithecellobium* are found to be polyphyletic.

The following features characterize most members: bipinnate leaves; abaxial position of the median petal; valvate petal aestivation; prominently exerted stamens; absence of fracture line in the seed. The seeds of Mimosoid species bear a fissure in the seed coat, a U-shaped single or double line found on both faces of the seed and

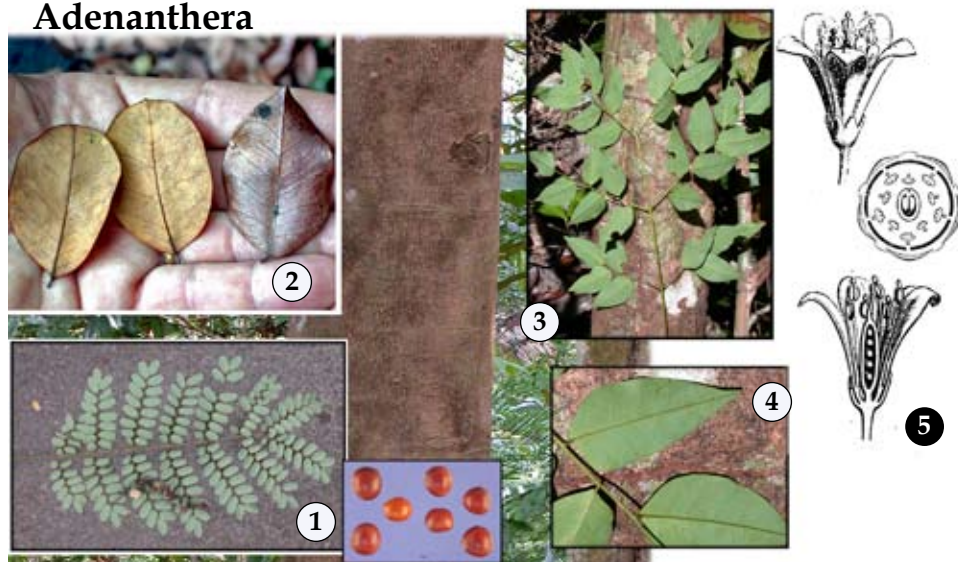
sometimes continuous between them. This feature is termed a pleurogram and distinguishes the Mimosaceae from most other legumes. The size and shape characterizes many individual genera.

This subfamily is of singular importance in Australia, America and to a lesser extent, in India and Africa. However with regard to the trees of the lowland equatorial forests of tropical Asia the Mimosoids are of decidedly minor significance: a few *Parkia*, a handful of *Archidendron* and in the gaps and forest margins a few *Albizia* and *Adenanthera*. As we move north into the Philippines and west toward Thailand and India that we begin to add genera and species of greater abundance. A few additional genera might have been added: *Dichrostachys cinerea* is a cultivated species from Africa, reported as naturalized in tropical Asia, which may only be true in Java. *Schrunkia quadrivalvis*, from Mexico, possibly naturalized in the Philippines.

ADENANTHERA. [Greek, gland-bearing flower.] About 12 species in Asia and the Pacific. Most are medium-sized fast growing trees reaching 30 m tall, leaves twice-cut, three to six opposite pinnae with eight to 16 alternate leaflets per pinnae, the leaflets with a jointed pedicel and a persistent basal part. The most abundant is *A. pavonina* (usually including as a synonym *A. bicolor*). Known most widely by the Malay name *saga*. From Sri Lanka east throughout tropical Asia, but evidently only cultivated and naturalized in the Philippines.

XYLIA. [Greek, wood, exceedingly hard.] 12 species in Africa and Madagascar and one species in Asia, *Xylia xylocarpa*, leaves bipinnate, leaflets opposite, flowers male and bisexual in a globose head, the hard fruit boomerang-shaped. It is found in central dry-seasonal Asia from India and Burma to Indochina, in deciduous forests with or without fire. Sometimes falsely claimed for the Philippines, possibly confused with *Sympetalandra*; there seems no evidence that it occurs east of the Mainland. The phylogenetic studies cited above sampled only the African species.

Adenanthera



Adenanthera. 1-4, *A. malayana*; 1-2 trunk with finely textured pink-red bark, leaves of mature tree, the apex of which can be rounded, pointed or notched, Bukit Timah, Singapore; 3-4, Malaya, here the leaves of a juvenile 2 cm DBH, the apex pointed; 5, the red seeds (from India) with the faint pleurogram marking the surface, seeds in Malaya are often half black in color; 6, line drawing of flower from BALLION *loc. cit.* (Photograph 5, public domain from USDA.)



Xylia xylocarpa, on a hillside in central Vietnam, the leaf with a single pair of pinnae each with five pair of leaflets; a raised gland sits at the apex of the main rachis.

VACHELLIA. The old genus *Acacia* includes five distinct groups, the most divergent of which is a relatively small group that includes the cutch tree, and unfortunately also includes the original type species of the genus, *Acacia nilotica*. It is unfortunate because in the course of

the necessary division of *Acacia*, the genus name should follow the type species. However, a controversial decision at the Vienna Botanical Congress in 2005 changed the type species of *Acacia* to *A. penninervis* so that the 900 species of the largely Australian subgenus (formerly subgen. *Phyllodineae*) will remain as *Acacia*. The name *Vachellia* has been resurrected for what was formerly *Acacia* subgenus *Acacia*.

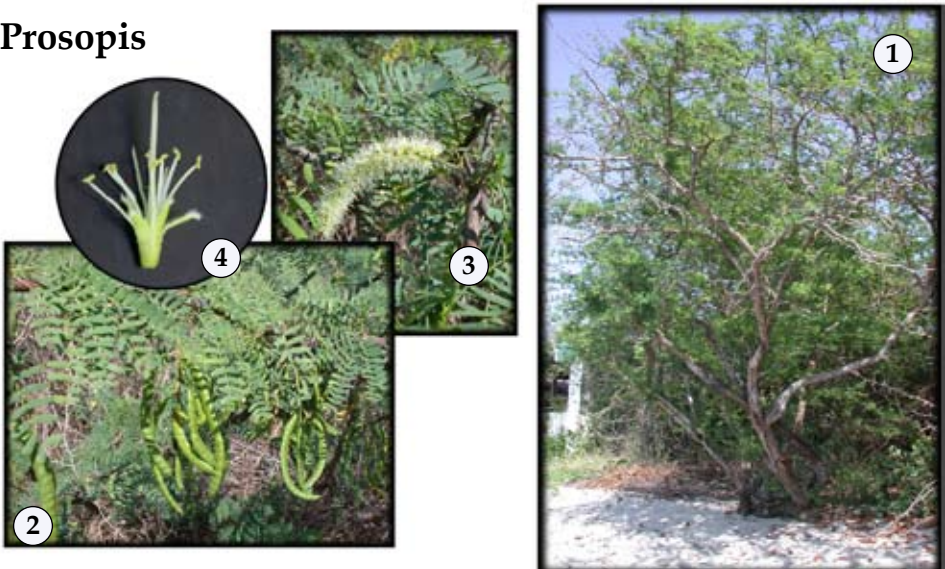
PROSOPIS. [Latin, but derived from Greek for face, possibly in reference to the pleurogram on the seed.] *Prosopis juliflora* Spanish bayahonda blanca, the deepest penetration of roots recorded 53 m in Arizona, related to the mesquite, good a fire wood; invasive in India, Australia, Philippines for centuries, aromang dagat, figured in Blanco's Flora, not listed in the Flora of Thailand, but surely there. Often no more than a sprawling colonizer of sand, but able to form a strong main stem to 40 cm DBH. Probably the most vicious of our straight thorns - very sharp and very strong, able to cut through most shoes.

LEUCAENA. [Greek, probably in reference to white flowers.] A genus of tropical America comprising 22 species, with *L. leucocephala* widely planted for fuel and erosion control. It is naturalized in all of tropical Asia, exceedingly abundant especially on open land and near seashores. The common name is *ipil-ipil* in the Philippines for the pods like cockroach wings.

SCHLEINITZIA. [Commemorates G. Schleinitz, first administrator of German New Guinea.] Four spe-

Orchard, A. *et al.* 2005. Taxon. 54: 509-512.

Prosopis



Prosopis juliflora, an abundant invasive weed tree of beaches and degraded lands in tropical Asia, here in the Philippines; 1, forming a strong central trunk up to 20 cm DBH; 2, the pods are eaten by livestock as forage; 3-4, the floral spikes comprise many small typically mimosoid flowers.



Leucaena leucocephala, along a roadside in the Philippines; inset of the flowers.

cies of the Pacific, close to *Prosopis*. *Schleinitzia megaladenia* in the Philippines. (Not illustrated.)

PARKIA. [Commemorates Dr. Mungo Park, died 1806 exploring Africa.] 35 species, American 17, African four, and Asian 12, India to New Guinea and Philippines. All Asian species belong to the monophyletic section *Parkia*, which is itself divided into two monophyletic clades, one in the Paleotropics and one in America. (Analysis to date is based on morphology alone, molecular evidence wanting, and proper outgroup is debatable.)

These big handsome trees do as well in the lowland equatorial forests as they do in strongly seasonal lands. They can be found in almost every forest: *P. speciosa* all over the Sunda Shelf (*petai*), *P. timoriana* in the Philippines (*kupang*) and *P. leiophylla* in Mainland SE Asia. However, there are other less abundant species that likely are mixed here because the Asian species of *Parkia* are all closely related to one another and are vary in minor details of leaf and pod form, a situation that, combined with the poor quality of most herbarium specimens, has frustrated a completely sound taxonomy. The genus needs a regional student and more extensive field study focusing on inflorescence position, branching, floral details and pollination.

These trees bear feathery leaves, twice cut with 10 or more pinnae, numerous strictly opposite leaflets, and a diagnostic inflorescence. The flowers are borne in a dense head, each head with three types of flowers: staminate flowers at the distal (basal portion) and bi-sexual (or sometimes pistillate?) flowers near the apex, with an intervening region of specialized sterile flower that pro-

duce nectar. All species of section *Parkia* are presumed to be bat-pollinated: *Megachiroptera* pollinate the Asian species and *Microchiptera* pollinate the American species. The clade sister to section *Parkia* (and restricted to America) includes both bat and insect pollinated species and a wider variety of floral forms including red flowers. Some of the American species specialize in the strongly seasonal savannah-like forests, and others of the white-sand forests, whereas their Asian cousins, while found in strongly seasonal places are chiefly confined to damper river banks. In phenology, the trees are strongly seasonal, often leafless for a brief period, with more or less regular annual flowering and fruiting. Mammals and birds will take the fruit, but most are destructive of the seeds. It is not clear what animals is the effective disperser. The seed coat varies from soft to very hard, and may relate to dispersal.

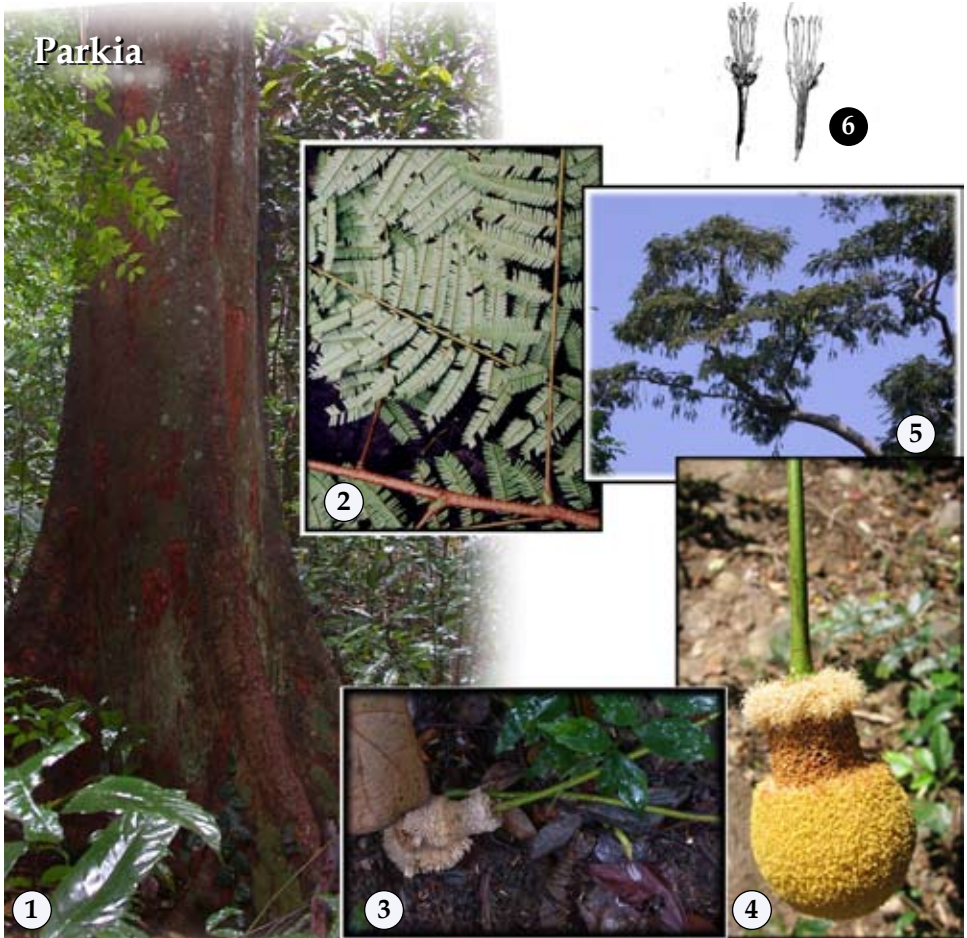
The fruit of *P. speciosa* (and other species in Thailand, but not *P. timoriana*) are commonly and widely collected from the wild for the slightly bitter and garlic-smelling seed and aril, the latter eaten fresh, the former typically cooked especially as the *sambal petai*.

THAILENTADOPSIS. [A clumsy compound name referring to Thailand and beans.] Two or three species of small spiny trees in Mainland SE Asia, especially *Thailentadopsis tenue* with a superficial appearance as in *Pithecellobium dulce*, that is, with a single pair of pinnae, each with one-three leaflet pairs, with stipular spines, but here the seed with a pleurogram and lacking an aril, thus distinct from *Archidendron*.

PITHECELLOBIUM. [Greek for monkey's ear-ring, in reference to the coiled fruit.] Now sensibly treated in a narrow sense of Neotropical species with spinescent stipules, uniform flowers (thus differing from *Albizia*) and funicular aril (differing from the largely Asia *Archidendron*). The best known species in Asia is the casually cultivated and naturalized tree of the Americas, *Pithecellobium dulce*. Native to Mexico and brought to



The fruit of *Parkia speciosa* are among the most important of vegetables gathered from the wild forest populations. When in season, the fruit can be found in most fresh markets in Malaya. Only the seed and its thin aril are eaten.



Parkia. 1-4, *P. speciosa*, Singapore; 1, trunk with red bark and short rounded buttresses; 2, fallen inflorescence; 3, feathery leaves; 4, fruit in a fresh market; 5-7, *P. timoriana*, Philippines; 5, large overgrown trunk, nearly 1 m across; 6, pendent clusters of fruit high in the canopy; 7, inflorescence; 8, floral illustrations showing inflorescence, staminate flower and pistillate flower, from BALLION *loc. cit.*; (photograph 7 © Ulysses Ferreras).

the Philippines by the Spanish in the 18th Century, it is known there by the Aztec *kamochitile* and the possibly derivative name *damortis*. The fruit of these trees contain a thick arillate pulp, astringent, sometimes slightly sweet and acidic, eaten raw or made into a drink similar to lemonade. The once popular fruit still show up in markets from time to time, however they are decidedly regarded as 'old-fashioned'. The base of each leaf bears a pair of short, sharp spines.

SERIANTHES. [Greek name for a composite, maybe in reference to the flower.] 20 species, one in Thailand, four in *Flora Malesiana* region including *Serianthes grandiflora* in the Philippines.

PARASERIANTHES. [Close to *Serianthes*.] One or more similar species of large fast-growing trees. *Paraserianthes falcata* is sometimes called *Albizia falcata*

but it also has been called *A. moluccana* and *A. falcata*. It occurs naturally in Indonesia, Papua New Guinea, and the Solomon Islands, but is planted throughout tropical Asia.

ARCHIDENDRON. [Greek, reference to its superior appearance.] A genus of about 114 species from India (two species and only in the very south), Sri Lanka, and east throughout tropical Asia, nine Thailand, 16 in S China, 21 in Indochina, about 12 in Malaya, 14 in Borneo, eight in the Philippines. Almost all are medium to small trees of the dry-seasonal forests, and also wet lowland rain forest, found especially along forest margins, old gaps and older secondary forests. The leaves are without spines, twice cut, sometimes only two pinnae, the uppermost pinnae often the longest, leaflets opposite, often asymmetric. The rachis bears prominent glands. The flowers are uniform and bisexual, the stamens more than 15, united filaments mostly shorter than the co-



Archidendron. 1-4, *A. clypearia*, Malaya, variable in leaf size, but one of the most widely collected forest species of *Archidendron* in the Sundaic Region; 5-6, *A. triplinervium* from Sarawak, note the pendent blue seeds without an aril; 7, the trunk of *A. jiringa*, from Sarawak, with a thin gray bark. (Note that *A. jiringa* is not the tree known as *jiring* which is *A. bulbinum* as below.)

rolla tube. The seed is often a blue color, without an aril, without a pleurogram. Many of our fast-growing ruderal species are well known. A few species are at home in the shaded forest, the most notable of which is *Archidendron*



Archidendron bulbinum, Pasoh, Malaya, a forest tree 23 cm DBH; the leaflets are about 12 cm long; the seeds, with and without the crisp black seed coat, are sold in markets as *jiring* to be cooked in a manner similar to *petai*.



Paraserianthes falcataria, cultivated Singapore; although of huge dimensions, the tree is among the fastest growing of all trees and is not very old. (Photographs © Joseph Lai.)



Pithecellobium dulce, a tropical American tree, widely planted and naturalized in tropical Asia, here a semi-wild type in the Philippines, the mature pod splits to reveal the pendent seed surrounded by the dry white aril, the leaflets in pairs.

bulbalinum, called *jiring* in Malay, and collected for the edible seed.

WALLACEODENDRON. [Commemorates Alfred Wallace, foremost naturalist of tropical Asia, co-author with Darwin of first paper on evolution by natural selection, etc.] Monotypic, represented by the singular *Wallaceodendron celebicum*. Basically an *Archidendron* but with straight thick fruit. The leaves are large and coarse. Although the specific epithet implies a home in Sulawesi - which is indeed the source of the type material - the tree is more characteristic of the dry-seasonal parts of the Philippines, especially along sandy forests near the ocean.

ALBIZIA. [Commemorates F. degli Albizzi, Italian nobleman who introduced *A. julbrisin* to Europe.] A pantropical genus of 150 species, 13 in Thailand, eight in the Philippines, six in Borneo. The genus includes trees shrubs and lianas, without spines and the seeds without arils. *Albizia lebbbeck*, *A. lucidor*, Locally common gap species.

A. saman. The species has synonyms under most of the relevant genera including: *Samanea*, *Inga*, *Mimosa*, *Pithecellobium*, and *Enterolobium*. It is both curious and confusing that that it should be universally known in the Philippines as *akacia*, when *Acacia* is one genus with which the species has never been associated. Likewise, the English 'Rain-tree' is another puzzle in that there are

a half dozen expansions of the name. Most likely is for the exudate from cicadas. An older Malay name is *pukul lima* in reference to the closing of the leaves at sunset.

This tree is the most notable of cultivated legumes in open parks, plazas and any expansive area; it forms a broad wide crown and a dense shade. Brought to the Philippines in the early days of Spanish rule, it was planted around every town plaza and quickly became a central element in the social and architectural history of the Philippines. A few of the older trees that date to the early 18th Century still presist, but most of the large trees were planted in the first decade of the 19th century. The popularity of the species took it to most cities of tropical Asia during the 19th century and large trees can be seen in the *padang* in Kuching, Sarawak, in Singapore, and around Kuala Lumpur. The large thick trunks are often cracked and twisted. While not much used for ordinary carpentry, they are highly prized in the Philippines for carving larger-than-life statuary.

The central flower that terminates the inflorescence is very much larger than the flowers to the side that make up the rest of the flower head, and the staminal tube is often greatly enlarged, and a strong nectary ring surrounds the ovary, the central flower almost never sets a fruit itself, but presumably acts to attract insects. Freely fruits, naturalized to some extent in Asia, certainly invasive in Fiji and Hawaii but weakly so in continental Asia.

ACACIA. [Ancient Greek name for an African tree.] For over a century, *Acacia* has been treated as a single entity, species-rich with over 1200 species, and with



Wallaceodendron celebicum, cultivated in Manila Zoo; note the twice-cut leaves and thick fruit pods.

Albizia



Albizia saman, often noted as *Samanea saman* or Rain Tree, was brought from the American Tropics centuries ago. Th low spreading hemisphericl crown is entirely atypical of trees in tropical Asia, but it so useful in urban settings that it quickly became one of the more popular trees to plant in plazas or padangs throughout Tropical Asia. The tree illustrated adorns the campus grounds of the Forestry School of University of the Philippines in Los Banos and is a little over 100 years old.



Albizia



Albizia



Albizia lucidor, a lower canopy tree of dry-seasonal forests from India to Mainland SE Asia, (from BRANDEIS *loc. cit.*)

both natural and cultivated species of singular economic significance. (Included in the genus are species such as *Acacia nilotica*, the dominant, and often the only tree of the dry Indian plains; *A. arabica* is among the most important trees of drier parts of India, and one the most important source of tanins. *A. leucophyllum* is the basis for the lacquer industry in Myanmar, (Check Burkill?).) and *Acacia koa*, is the Koa tree of Hawaii and one its most important woods. Several species are widely cultivated sources of cheap timber: *Acacia auriculiformis*, and *A. mangium* are the most notable in our region. They are remarkably fast-growing in even the most degraded soils. The 'leaves' are extraordinary, perhaps derived from a portion of the midrib and flattened at right angles to the twig so as to form a sort of blade tipped by a large gland.

In tropical Asia, the genus is unknown among trees of the wet lowland rain-forest, although Malaya claims three species of lianas. *A. confusa* is said to be native to the Philippines and Taiwan. Nearly a dozen species are represented in the Indo-Burmese and Indochina area. *Acacia harmandiana* is one of the few native trees of *Acacia* found in Mainland SE Asia, growing 10-20 m tall in the bamboo forests and savanas from Laos to Myanmar. *A. catechu* cutch tree, to 15 m tall, widespread in India, Myanmar and Thailand. The bark is dark gray in small broken rectangular plates. The cutch tree has been cultivated since ancient times for tannins. The wood is chipped and boiled into a thick gum.

Molecular data makes a strong case for the polyphyly of *Acacia* and thus the necessity of its division. To avoid changing certain names, the type species of the genus was recently chosen anew, now to reflect the largely Australian group of species. The group surrounding the

former type species, *A. nilotica* appears to be unrelated to the other *Acacia* will be treated as genus *Vachellia*.



Acacia

ROSALES

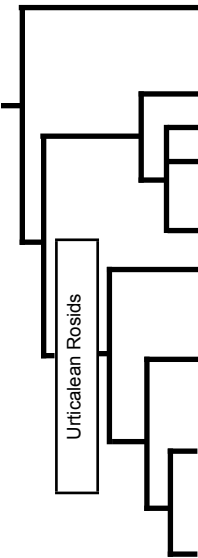
The roses are such a well known kind of plant that it is surprising that their nearest relatives have never been clearly identified. The order Rosales was formally published in 1824, but it has been used in a highly heterogeneous fashion: James Reveal included no more than the Rosaceae itself, while the Rosales of Cronquist included 24 families, all of which are currently scattered throughout the angiosperm phylogeny. The order now comprises nine families, 261 genera, and 7725 species following APG III and STEVENS *loc. cit.* The phylogeny below follows the analysis of *rbcl* data by Sytsma and colleagues¹. The arrangement of families is still debated. The large and heterogeneous family Rosaceae is distinguished by perigynous flowers with an inferior ovary whereas the Urticalean Rosids, the former Urticales, is distinguished by highly reduced flowers typically aggregated in specialized inflorescences.

Members of the Rosales are especially abundant in well-lit places, and less common in the shaded forest understory. The Rosaceae itself is largely restricted to North Temperate Zones, and in the tropics to exposed areas in the colder mountains. With regard to nutrients,

it might be appropriate here to mention what has come to be called the “nitrogen-fixing clade”. While all plants require nitrogen for growth, only a few groups have hit upon a method of augmenting their supply through a symbiosis with microorganisms that naturally fix atmospheric nitrogen. Many species of the Fabaceae (Fabales) have a symbiosis with *Rhizobium* or other bacteria that fix nitrogen in specialized root nodules. Somewhat less known is the symbiosis with actinomycete *Frankia* which fixes nitrogen in many members of the Fagales, *Casuarina* most notably. (Additionally, many Fagales are strongly ectomycorrhizal, and the entire complex relationship between nodulating bacteria and mycorrhizae is still being explored.) Actinomycetic nodulation is found in a few scattered members of the Rosales as well, but sparsely so: *Elaeagnus* (Elaeagnaceae) and four genera of Rosaceae. Curiously, a *Rhizobium* symbiosis is found in *Parasponia* (Cannabaceae). The three orders Fabales, Rosales and Fagales, together with the Cucurbitales, comprise the “nitrogen fixing clade”. The ecology of nutrient use in the Rosales merits much more attention. Many Urticalean Rosids are “fertilizer hogs” in the same fashion as the cultivated rose; their local distribution is often biased toward sunlit places over nutrient-rich soils such as alluvium, rich clays and wet limestones.

¹Sytsma, K. *et al.* 2000. American Journal of Botany. 87 (6, suppl.): 162.

Phylogeny of Rosales

	Family	Diversity and Distribution	Trees of Tropical Asia
	Rosaceae	90/2520, cosmopolitan, herbs, shrubs, small trees.	<i>Prunus</i> , both seasonal and lowland everwet forests, and a handful of small trees of dry-seasonal lands, especially mountains.
	Barbeyaceae	1/1, tree, NE Africa.	0
	Dirachmaceae	1/, shrub, E Africa.	0
	Rhamnaceae	52/925, cosmopolitan, woody, climbers, shrubs, toothed leaf margin, characteristic nervation.	Chiefly thorny lianas, a few trees, especially ruderals, <i>Alphitonia</i> .
	Elaeagnaceae	3/45, shrubs, N Hemisphere.	1, <i>Elaeagnus latifolia</i> .
	Ulmaceae	6/35, flowers bisexual and mixed, apically attached ovule, flat seed, lacks endosperm, nerve enters marginal teeth, clear exudate.	2/2, uncommon, especially Mainland SE Asia, seasonal uplands, <i>Ulmus lancefolia</i> , <i>Holoptelea</i> .
	Cannabaceae	11/130, comopolitan, flowers unisexual, apically attached ovule, rounded seed, with endosperm, leaves pinnately nerved, vein enters marginal teeth, clear exudate.	<i>Trema</i> in full sun; <i>Aphananthe</i> and <i>Celtis</i> in dry-seasonal places; <i>Gironniera</i> , abundant in Sundaic lowlands.
	Moraceae	38/1100, woody, tropical, flowers unisexual, 2 styles, 2 stigmas, apically attached ovule, leaves pinnately or palmately nerved, vein enters marginal teeth, milky eudate.	Species-rich and abundant in all parts of tropical Asia: <i>Ficus</i> , <i>Artocarpus</i> , <i>Streblus</i> etc.
	Urticaceae	54/2625, mostly tropical, herbs, flowers unisexual, 1 style, 1 stigma, basally attached ovule, leaves pinnately or palmately nerved, vein enters marginal teeth, watery exudate.	Chiefly species-rich and abundant herbs, sometimes locally abundant small soft trees of wet open places: <i>Boehmeria</i> , <i>Dendrocnide</i> , etc.